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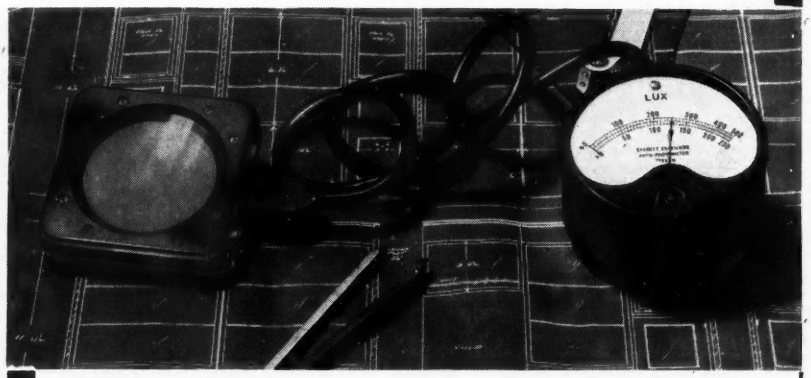

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ELECTRICAL REVIEW

Vol. CXLVII No. 3813 22ND DECEMBER, 1950

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

The Need for Light

MODERN CONCEPTIONS AND METHODS

IN the historic Church of St. Margaret, Westminster, there was a window presented by the printers of London in 1882 as a memorial to William Caxton whose press was in the neighbourhood of the church. The window was destroyed during the bombing of London but a tablet on the wall below it remains. This bears a quatrain by Tennyson on Caxton's motto: *Fiat lux:—*

> "Thy prayer was Light, more Light—
> while time shall last,
> Thou sawest a glory growing on the night;
> But not the shadows which that light
> would cast
> Till shadows vanish in the Light of light."

We are all acutely conscious to-day of the shadows cast by the complexities of life. More light is indeed needed to guide us in this distracted world as well as to lighten our daily visual tasks. Yes, let there be more light everywhere by all means although not by any means.

Phenomenal Progress

One has but to reflect that thirty years ago the provision of 5 ft-candles was considered to be good lighting, while H.M. Factory Inspectors thought one-half that amount was sufficient for many kinds of work. To-day the Lighting Service Bureau is demonstrating that 100 ft-candles need not be uncomfortable, when suitably arranged, so that we may expect before long to begin confidently talking about intensities of that order.

Such a level of illumination will not become sufficiently general immediately to affect the power production situation, but electrical energy is not likely to cost less in future; in fact the B.E.A. expects ultimately to have to raise the prices to consumers. Nevertheless more electricity was used last year for street lighting than in the previous year, notwithstanding the appreciable increase of the cost of electricity for this kind of public lighting in many places since vesting day.

Questions of Cost

There is presumably no better alternative in this instance, but the lighting of industrial interiors has to be looked at in a different way. While the installation cost of tungsten filament lamps in diffusing fittings may be less than that of fluorescent lighting, the energy consumed and load created by the former will be larger than in the case of the latter. The saving in first cost can easily be more than cancelled out by the additional cost of generating, transmitting and distributing the extra electricity involved.

Capital spent for this purpose needs to be more generally balanced against the increase in productive output per man which undoubtedly accrues from the provision of adequate light in factories.

If the efficiency of a works depends to a large extent upon the ability of the workers to see clearly what they are doing, should they be subjected when they reach their homes to the fatigue of illumination much inferior to that to which they are becoming accustomed at their places of business? We should hate to think that the householder runs any risk of being "over-sold" on lighting, but anyone who concerns himself sympathetically with domestic illumination is doing the community good service.

It is the aim of the authors of the special articles in this issue to show what sort of installations give the best results in a variety of applications.

LONDON OR PARIS?

In a very few months we shall be inaugurating the Festival of Britain. At the same time celebrations are being arranged in the French capital. Each district of the city will be *en fête* in turn during the tourist season. There is very little time left in which to see to it that in this rivalry between Paris and London to be the brightest and most cheerful capital in the world London does not take second place.

COOLING TOWERS

The means devised by the B.E.A. for stopping the annoying drizzle from water cooling towers at power stations, which can be a nuisance at times in some localities, is notable in several respects. It is effective, as was demonstrated at Croydon recently, as well as simple and cheap. Since the cost of abatement will ultimately have to be borne by all consumers of electricity, the economic aspect of preventive steps is not merely an internal issue. Modern cooling towers are large; there are many of them in this country and more will be needed. It is therefore to be hoped that equal success will crown the efforts of the B.E.A. research engineers in finding ways and means of reducing the size and cost of the towers.

STORAGE HEAT-PUMP

The storage of heat in various ways is an established practice but, until recently, no one seems to have contemplated using the principle for augmenting the peak capacity of a heat-pump installation. By taking advantage of the heat of fusion of appropriate chemicals (solidifying-melting) it may be possible to reduce the volume to something like one-fourth that required when water alone is employed as the storage medium. It may also enable a 3 h.p. plant to do the work of a 5 h.p. pump. Laboratory tests at the Massachusetts Institute of Technology, sponsored by the Edison Electric Institute, have reached the stage at which an experimental installation in Roanoke, Virginia, will shortly commence heating a residence. Water will be circulated in a closed circuit over some 4,700 small cylindrical containers filled with a commercial grade of sodium phosphate ($Na_2HPO._412H_2O$) inside a 275 gal storage tank. It is thought that for residence heating in some localities this method of storage may be justifiable on a first cost basis, apart from the expectation that the overall operating efficiency may be raised.

DISTRIBUTION NEEDS

What is loosely termed "capital restriction" in connection with electricity supply is not quite that. No doubt full capital needs, regarded merely as money, could be obtained, but in the absence of an increased availability of labour and materials this would merely mean higher prices to secure the same results. What is restricted, or "allocated," is the supply of labour and materials—the cloth from which so many suits have to be cut. We have consistently held that electricity supply is not sufficiently regarded by those who have the task of allocation. It is probable that "capital" allowances for generating and boiler plant are now adequate, in the sense that they represent as much as can be produced at present by manufacturers, but on the transmission and distribution sides, where the cuts have been made, it is essential that more labour and materials be made available. Lord Citrine has pointed out how delicate the position is in this respect and how great the danger of serious breakdowns.

SEASON'S GREETINGS

As usual at this time of year we gratefully acknowledge the many greeting cards and calendars which readers have sent us. It is our earnest hope that in spite of present world troubles they will enjoy their Christmas and be able to look forward to better times in the New Year.

Commercial Lighting

Modern Treatment of Office Accommodation

By T. S. JONES*

Fig. 1.—Entrance hall, Portland House, Tothill Street, Westminster

DURING the past seventy years great changes have taken place in our way of life, particularly in commercial life, and many of these changes are reflections of a more practical relationship between employer and employee. Contributory to and coincident with the development of commercial life has been the growth of applied electricity, which makes such a large contribution to modern commercial life.

Mechanized systems of accounting, addressing, computing, printing and duplicating, receiving dictation and transcribing, teleprinting, etc., all show how electricity has become part of the staff, but how incongruous it would have been to find all these accepted aids used in the old-fashioned high-desk and perch stool places of not so very long ago.

Improvements in office layout were necessary to ensure the best use of the equipment and, at the same time, improved surroundings, more cheerful, clean and tidy, were appropriate to the new outlook. Decoration, not embellishment, has become a major consideration ranking in importance with ventilation and heating and, of course, closely allied with lighting.

The improvements in these amenities are more dependent on each other than is usually appreciated. Light colours, so essential for efficient and effective conditions of seeing, cannot be maintained economically if subjected to the dust of open fires or the fumes of old-fashioned gas heaters. In some of our larger cities it is very doubtful if ventilation from open windows is economical due to the dirt which accompanies the air, and certainly well-planned air conditioning contributes both to the comfort and cleanliness of a building in such places. The electric incandescent lamp removed yet another source of fumes and dirt to allow both the ventilation and the decoration to be planned to benefit the user's sense of comfort, efficiency and economy. Even the cost of electric light has been consistently reduced and is probably the only universal amenity to be lower in price now than in 1914.

That quality of lighting is vastly superior to-day in progressive commercial buildings is a generally accepted fact but even so there is often a waste of good material due to lack of proper planning and poor choice of equipment, which just fails to produce the best result. It is therefore not surprising that more and more architects and business people are taking advantage of the specialist advice now available.

In the accompanying illustrations and diagrams can be seen the kind of result now easily possible and, although post-war

*Crompton Parkinson, Ltd.

construction has been relatively small, considerable renovation of offices reclaimed from wartime usage provides plenty of examples of harmonious results.

First impressions are important so the outer entrance hall of a large office (Fig. 1) uses a specially constructed lighting fitting to give a soft glareless light over the walls and floor and to impress the visitor with the powerful character of the concrete figure on the right.

The main reception hall (Fig. 2) is treated decoratively by a geometrically patterned floor in two colours harmonizing with attractively configured timber veneered walls divided by aerofoil spars of contrasting coloured timber. Deliberately to enhance the effect of walls and floors, " Louvalite " ceiling illumination from " natural " fluorescent tubular lamps performs its duty with unobtrusive simplicity and serves economically to reduce the level of an unduly high ceiling while hiding unwanted, but necessary, beams and services.

In complete harmony with the dignity of the reception hall and similarly treated corridor landings are the various offices of directors and executives, each of which is individually styled, decorated and illuminated. For example, Fig. 3 shows how excellent an effect can be created by intelligent co-operation of the interior decorator with the lighting engineer. General illumination is provided from indirect cornices equipped with " mellow " tubes and anodized aluminium reflectors housed in an outer casing which is coloured on site to suit adjacent decorations. Local additional desk lighting, although not essential, brings added interest to the room and is useful for concentrating attention on any particularly fine task.

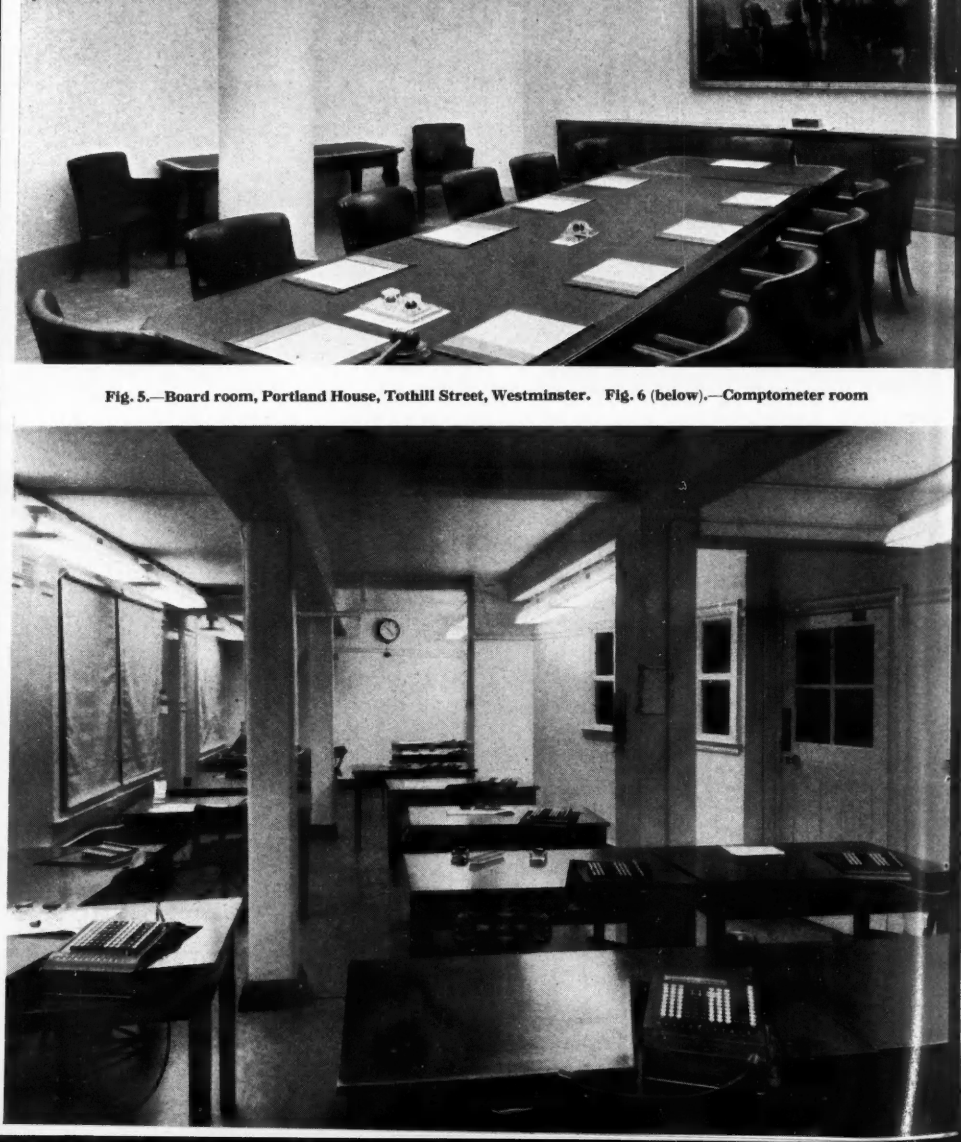
The natural daylighting of this room needs control to avoid sun glare and for this purpose a modern version of the venetian blind, constructed of fine curved section metal slats, allows direct or indirect light to be arranged while, at night, the closed position suggests continuity of the light wall surfaces. The success of this type of treatment is largely dependent upon careful selection of wall and ceiling colours to respond to daylight and artificial light sources.

An entirely different type of office is shown in Fig. 4. Here the existing fireplace, which occupies such a large part of the wall space, makes retention of the moulded plaster ceiling design necessary. In this

Fig. 2.—Reception hall, Portland House, Tothill Street, Westminster

Figs. 3 and 4.—Directors' offices, Portland House, Tothill Street, Westminster

Fig. 5.—Board room, Portland House, Tothill Street, Westminster. Fig. 6 (below).—Comptometer room



room the application of an indirect cornice would be unsightly and in any case the patterned ceiling does not lend itself to indirect lighting, which would tend to distort the apparent shape of the moulded plaster. Choosing lighting fittings with about 40 per cent output above the horizontal and large area diffusing panels in the sides and base ensures a pleasant effect with soft shadows in all recesses.

An unfortunate personal preference for glass on the desk tops tends to introduce reflected glare, but the large projected areas of the fitting and the comparable brightness of the surrounding ceiling minimize discomfort from this furnishing while the reflected glare from the desk lamp can usually be eliminated by the position of the large blotting pad. Full length curtains and a plain carpet complete a comfortable yet businesslike atmosphere.

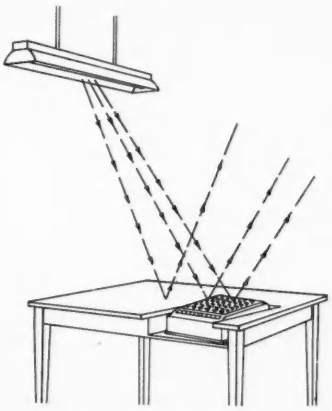
The next photograph of a board room (Fig. 5) is a fine example of indirect lighting by 500 W filament lamp pendant " Anoliers " in conjunction with a built-up feature around the pillar. In this, as in most indirect lighting installations, it is essential to avoid the use of glossy finishes for walls and ceilings. A compromise between maintenance and good effect is usually found by using " eggshell " finish for painted surfaces and low gloss polish for timber panels.

Turning now to the larger offices, it is usual to find that the various types of work tend to be sorted into separate areas, as for instance in typing pools, comptometer rooms, ledger work, etc. From the lighting engineer's viewpoint this is a good thing because the problems of seeing can usually be solved without resorting to untidy layouts.

Positions of desks, tables, or machines are usually fixed relative to windows, although the useful light from windows may not penetrate far across a room. Positions of artificial lighting fittings are usually affected by furniture and equipment arrangements and even in general lighting installations it is wise to study these arrangements carefully.

Haphazard placing of lighting fittings often occurs because the positions of beams or other ceiling features appear to indicate a convenient series of spaced points. Sometimes such faults are the result of assuming that a knowledge of elementary layout and spacing/height ratios is enough to allow planning of any office job. Usually such layouts give rise to some dissatisfaction and often fundamental principles are ignored to the detriment of the job.

Sketch " A ".—Comptometer desk showing reflected beam passing to side of operator



To have enough light for the work is important but to couple with it quality of shadowing, hard or soft, directional effect to avoid troublesome reflections and colour of light acceptable for the conditions, is at least as important.

For instance, in a comptometer room (Fig. 6) the left-hand row of desks adjacent to the windows sets the relative positions of the inner rows of desks. Daylight strikes across from left to right and so direct reflections from the machine keyboards also travel to the right of the operator and not into her eyes.

Similar conditions are produced by placing one line of lighting fittings close to and parallel with the window wall (sketch " A ") so that reflections do not interfere with vision. A second line of fittings directs these specular reflections to the left of a second row of operators. Louvres attached to the reflectors prevent direct view of the lamps at normal angles of view and the use of " Perspex " reflectors ensures a comfortable ceiling brightness between and above the fittings.

Studied location of fittings in the above manner is often known as localized general lighting and another example (Fig. 7) depicts an office where reference is made to large bound books which are held open in a stand by the desk side. Here adequate light is essential over the desk area and on the page facing the clerk. Sketch " B " indicates

how alignment of the fittings almost down the desk centre ensures the right results.

In this class of work correct intensity is of importance and the ELMA/IES Code is a sound reference for any particular case. Suitably coloured window blinds combine with light walls to stop waste of light and to reduce the amount of electricity used.

Of course, general lighting symmetrically placed may often meet all needs. Fig. 8 shows a modern office treated in this way and using slotted reflectors to give light ceilings without glare.

It would not be right to leave this subject without reference to drawing offices, which are found in parts of most commercial office buildings. Traditional preference for individual local lights has been more difficult to change in such places than it has even in the workshops, yet, because of the nature of the work and materials used, local lights in drawing offices are usually more trying and annoying to the user and to surrounding workers than is the case elsewhere.

Fundamentally the main objects of the lighting engineer should be to eliminate shadow from instrument edges and troublesome reflections from surfaces of tracing cloth, photo prints, etc., while giving plenty

Fig. 7.—Ledger and accounting office. Sketch "B" (above).—Clerk reading opened ledger page. Note incident light at good angle to desk and to page

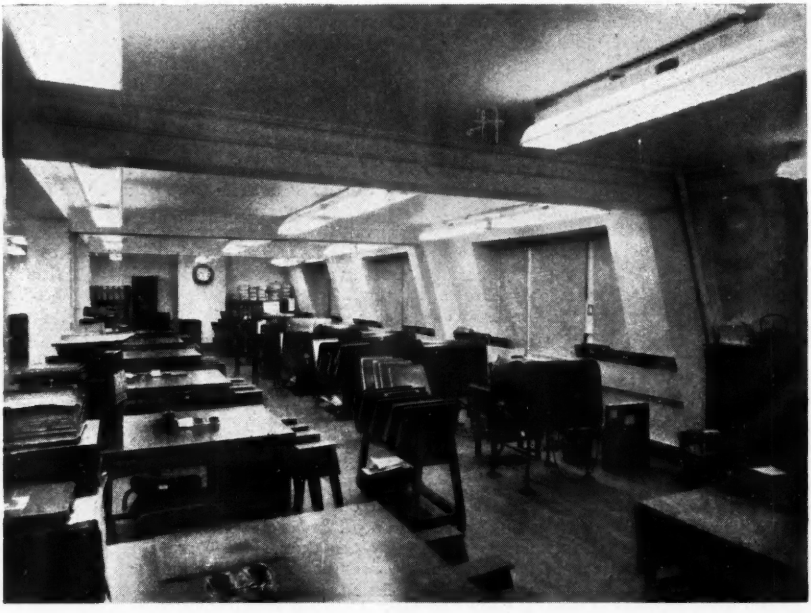
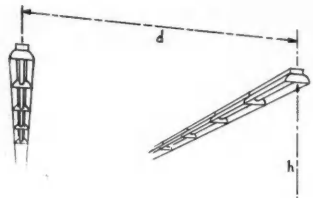


Fig. 8.—General office, Shell Petroleum Company. Fig. 9 (below).—Drawing office, Portland House, Tothill Street, Westminster



Sketch "C".—Drawing office position and minimum spacing/height ratio, h, to be not less than 0.8 d

of light to see fine lines; usually 30/50 ft-candles will suffice.

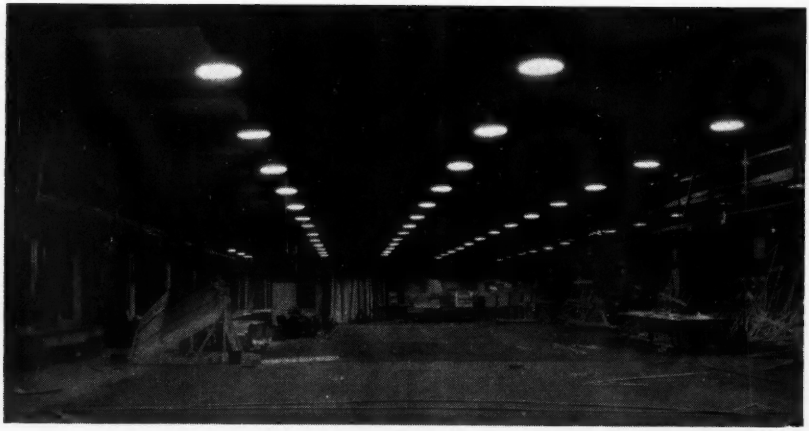
Fortunately, similar treatment solves both problems and, again, fittings should be aligned as shown between working lines and generally it will be preferable to keep the level of the fittings above the average level of the boards not less than 80 per cent of the distance between rows. Sketch "C" and Fig. 9 show how effective such an arrangement can be, even when horizontal and nearly vertical boards are used in the same room. For this kind of work "natural" or "daylight" tubes are usually preferred because of their good colour rendering over a wide range of hues and shades.

Should there be criticism of this article for illustrating fluorescent equipment almost exclusively, I could only say that the same principles apply irrespective of the light source used and that the economics of the case, coupled with the advantages of low brightness and excellent shadow control which characterize fluorescent lighting equipment, make it an obvious choice for the majority of such jobs.

Price and cost should not be confused because a good design which may not be the lowest in price can often be the cheapest to install and by far the cheapest to maintain. Good material, well chosen, properly installed to a well planned layout can guarantee long and satisfactory service at low cost.

Acknowledgments are made to the Associated Portland Cement Co., Ltd.; the Shell Petroleum Company; Holland Hannen and Cubitts, Ltd., including subsidiary companies; Colourpoint, Ltd.; and Electrical Service Installations.

NEW SHIPYARD LIGHTING



A new electrical installation forms part of the reorganization of the Pallion Shipyard of Wm. Doxford & Sons, Ltd., Sunderland. Metrovick equipment has been extensively used and a new lighting installation embodying Metrovick fittings was carried out by Watson-Norie, Ltd., Newcastle. The picture shows the lighting in the mould loft which has a value of 16-18 lumens/sq ft

Industrial Fluorescent Lighting

Simplified Trunking Method of Installation

By L. H. HUBBLE, F.I.E.S.*

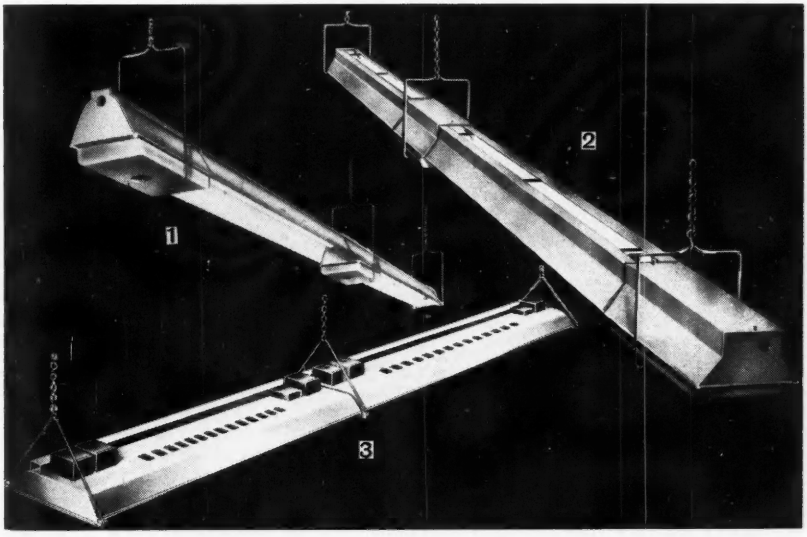
THE merits of fluorescent lighting in industry are such that, despite the undeniable facts that it brings in its train many electrical and mechanical complications and is far more costly than tungsten lighting both to purchase and install, the majority of new installations are fluorescent where this form of lighting is applicable.

It has been the constant endeavour of the company with which I am associated to simplify things wherever possible. In this connection improvement in lamp life, increased light output, and even better operation under load-shedding conditions are factors always under review, while the elimination of the starter switch in favour of a series transformer was another important step forward, particularly as regards maintenance. At the same time, and apart from these fundamental improvements in fluorescent lighting as such, the company has for a long time been concerned with the development of simplified methods of installation and as long ago as May, 1941, it introduced a system of continuous troughing calling for only one mechanical suspension per unit lamp length and incorporating a wiring duct whereby much conduiting was obviated.

The company cannot claim to have been the originator of the principle of joining fittings end-to-end, but it was certainly among the first in this country to put the idea into practice. The method was quite original, known as the "Napier" system, having been designed for the company of that name. It consisted of a series of cradles (Fig. 1) housing the control gear and spanned

* Interior lighting engineer, British Thomson-Houston Co., Ltd.

Fig. 1—Cradles housing control gear and spanned by reflectors and lamps. Fig. 2—Provision for some upward light; wiring channels formed by folds in the reflectors. Fig. 3—Third variant with externally mounted chokes



by the reflectors and lamps and was followed by another, providing a degree of upward light, the wiring channels (Fig. 2) being formed by folds in the reflectors. The designs of both these systems and one that came later still (Fig. 3) were dictated by the cubic shape of the choke, which did not allow it to be included in a continuous rectangular trunking, such as followed the introduction of the elongated choke.

The last-mentioned had been in common use in America for some considerable time before its introduction into this country, with the result that America was already well ahead on continuous trunking systems based on small rectangular section back channels. It was not surprising, therefore, that most fittings makers in this country produced equipment of a similar nature. A typical industrial reflector fitting of this type (Fig. 4) is the " Mazda " F1110.

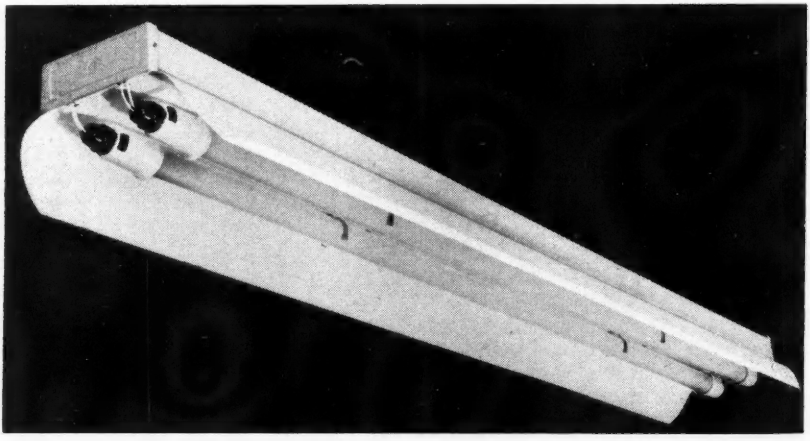
The prime intention of continuous trunking is to obviate the necessity for providing conduit to each fitting and, to a lesser degree, to avoid the need for two suspensions for each fitting. There is a great saving in installation costs under certain conditions, particularly as, in most cases, the trunking is made sufficiently large to accommodate a considerable amount of wiring.

With these systems, however, based as they are upon individual fittings linked together with special coupling pieces, or spacers, unless the scheme is more or less

regular, a good deal of complication occurs with the odd lengths and pieces, often specially made, which have to be provided.

The use of extruded aluminium section had been considered some time before its full significance was appreciated, principally owing to its apparently high cost. Investigations showed that the higher cost was easily offset by the advantages that could be gained from the many shapes and forms which were capable of being extruded, but could not be achieved by cold rolling. For

Fig. 4—Typical " Mazda " F1110 fitting based on small rectangular section back channels



New factory building of Vauxhall Motors, Ltd., Luton, lighted on the " universal trunking " system

instance, it was found that the incorporation of an extruded tee-slot—such as would take the head of a 2 BA screw—would obviate all the drilling previously necessary to secure the control gear to the channel. It also enabled the control gear to be placed anywhere at will. This tee-slot proved to be an extremely important feature because it immediately brought about a very considerable reduction of the labour cost of manufacturing fittings and did a lot to offset the high cost of the material.

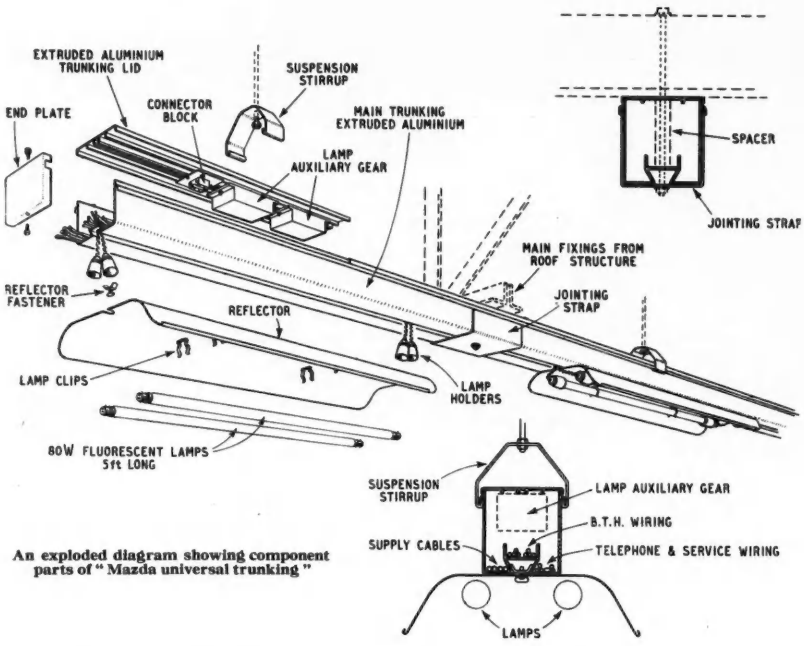
It followed that if the control gear could be attached to the inside of the trunking by means of a tee-slot and positioned anywhere at will, then the reflectors could be attached in a like manner, giving a degree of flexibility in planned lighting such as had not before been possible. Suspension arrangements came in for the same treatment ; the provision of two suitably formed ridges, one on each side of the trunking, made it possible to apply suspension stirrups anywhere in the length.

Sections of this kind could be satisfactorily extruded up to 30ft in length. Thus, so far, there was a form of trunking up to 30ft long in one piece capable of suspension at any point in the run and of housing both the reflectors and the control gear in any position without recourse to drilling, with the exception of the holes required for the lampholder wires.

Despite these many advantages the intrinsic cost was still high by comparison with that of individual fittings, but it was thought that when considered in conjunction with installation costs, provided that a considerable number of lamps was used per unit run, the overall cost would prove to be less than that involved in the use of individual fittings with their associated conduit system. Then, with the same object of taking full advantage of the extruded section, the idea of providing a special compartment or duct for other factory services such as visual signals, loud speakers, telephones, etc., was developed.

With these thoughts fully worked out the B.T.H. Co. had perforce to wait until a sufficiently large factory requiring fairly high intensity fluorescent lighting was built. The opportunity occurred in the new Luton factory of Vauxhall Motors, Ltd. That company decided to adopt this system, which has since become known as " Mazda universal trunking." The Vauxhall factory scheme covers a total floor area of 850,000 sq ft and 36,120ft of extruded aluminium trunking has been used, comprising 1,806 lengths of 20ft each. Also used are 6,896 ballast units, over 3,400 twin-lamp reflectors and 863 capacitors of 60 μF each.

There is no doubt that this installation is completely successful and the total cost, including those of erection and wiring, proved to be less than would have been the case had an equivalent system of individual fittings been installed.



An exploded diagram showing component parts of "Mazda universal trunking"

It can be foreseen that there is a great multiplicity of uses to which this trunking will be put in the future. It already has ample accommodation for lighting wiring and, if need be, small power wiring. Clocks, telephones, visual signals and loud speakers can all be wired through the trunking and the wedge-shaped reflector clamps can be used to support the loud speakers, clocks, etc., themselves.

At the Vauxhall factory the trunking is in 20ft lengths and a cover, to which the control gear is secured, is provided in three sections —two 2ft and one 15ft; the two short lengths have the gear attached adjacent to the suspension points in order to reduce deflection. The suspension points are at the roof trusses and one bolt is all that is required to support the adjacent ends of two runs. No other mechanical suspension was found necessary and the total deflection is less than half an inch. Since the trunking is made of aluminium special care has been taken to secure good earth continuity.

Two twin-lamp reflectors are attached to each 20ft length to give approximately 18 ft-candles. This in itself proved economical, but it is noteworthy that it would be virtually as simple to incorporate three three-lamp reflectors in the same 20ft length, giving nearer 50 ft-candles, with relatively little increase in cost since the major outlay is that involved in the trunking. These figures show that the higher the intensity required the more economical this method of installation becomes.

The introduction of this trunking is particularly significant in that it places a far greater premium on engineered lighting than the mere planning of schemes with standardized fittings. While not suggesting that the trunking will supersede individual fittings, except in large installations of fairly high intensity, it represents a revolutionary technique in which the established relationship between fittings making and the contracting business is materially altered. By simplifying the detailed construction of fittings and calling upon the contractor to do a little more circuit wiring than he would normally undertake, a much improved lighting system has become possible.

High-Bay Lighting

Examples of Recent Industrial Installations

By ERIC SMITH*

IT has been said that the lighting of large areas from sources which are mounted at considerable heights presents technical difficulties of great magnitude. This may be so, but it is at least possible to produce in this way a flexible layout while the determination of spacing ratios to height does not present any difficulty. Choice of light source, if not type of fitting, is varied and the chief problems seem to be those of installation and maintenance.

In illumination design it is as well to keep in mind the fundamentals, which in my opinion are (1) a lamp is there to give light; (2) a lighting fitting is a necessary evil and has three functions only—(*a*) to control the light from the source, (*b*) to afford mechanical protection for the lamp, and (*c*) to look decorative. In planning a high-bay lighting scheme, therefore, there is little to worry us if the problem is resolved step by step as one solves an equation.

The 80 W fluorescent and blended light lamps are not considered, as the high-bay lighting installations in question are strictly utilitarian and in my opinion any of the first five lamps mentioned in Table I will be suitable for any installation with mounting heights between 30 and 80ft. The first five lamps are known to everyone. They are well tried and each of them can be credited with many satisfactory and efficient installations. The sixth and seventh are new and, although limited in their application, are welcome additions to the range.

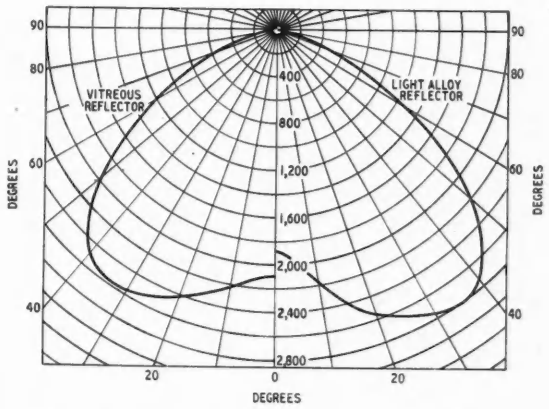
TABLE I.—AVAILABLE TYPES OF LAMPS

Type	Lumens/W average throughout life	Rated life
		hours
500 W tungsten	15·8	1,000
1,000 ,, ,,	17·8	1,000
1,500 ,, ,,	18·9	1,000
140 ,, sodium SO/H	57	3,000
400 ,, mercury MA/V	54	3,000
1,000 ,, ,, MB/V	56 initial	3,000
2,500 ,, ,, MA/V	50 to 52 initial	3,000*

* Still experimental regarding length of life.

Fittings to house these seven light sources are either concentrating or dispersive and it is in material, finish and detail only that the lighting engineer can vary his design. His basic idea will remain the same; he is only concerned with (*a*) controlling the light source and (*b*) affording mechanical protection for the lamp.

The following conclusions have been arrived at by the development laboratory



Comparative mean vertical polar curves of circular type L.1816 reflector fittings

* Simplex Electric Co., Ltd. Registered Lighting Engineer, I.E.S.

of Tube Investments, Ltd., from tests with a Simplex deep dispersive reflector (Cat. No. L.1816) which were made to obtain comparative figures. The source used was a 400 W MA/V mercury vapour lamp in a vitreous-enamelled reflector taken from stock and a reflector made from light alloy (No. 22) which had been etched and anodized. Vertical angles in the co-ordinate system were measured from zero at the nadir of the fitting.

The measurements of light intensity were made with an electrical photometer at a distance of 50ft from the fitting, a factor of 17 per cent being added to all readings to correct for the mercury vapour lamp. For each vertical direction readings were taken every 10 deg horizontally and the mean of these is the quoted value. Tests were made with the lamp situated at the lower extremity of the focusing adjustment, this position giving approximately 20 deg cut-off.

It would appear from Table II that, initially at any rate, there is little to choose between the vitreous-enamelled and anodized aluminium reflectors. The results obtained in this comparison are confirmed by the findings of J. M. Smith and N. B. Burroughs of the General Electric Co. of America who, in an article contributed to *Illuminating Engineering*, publish the Table III percentage of reflectors with one 1,500 W filament lamp operated for 16 hours a day.

TABLE II.—TEST FITTING L.1816 : MEAN VERTICAL DISTRIBUTION

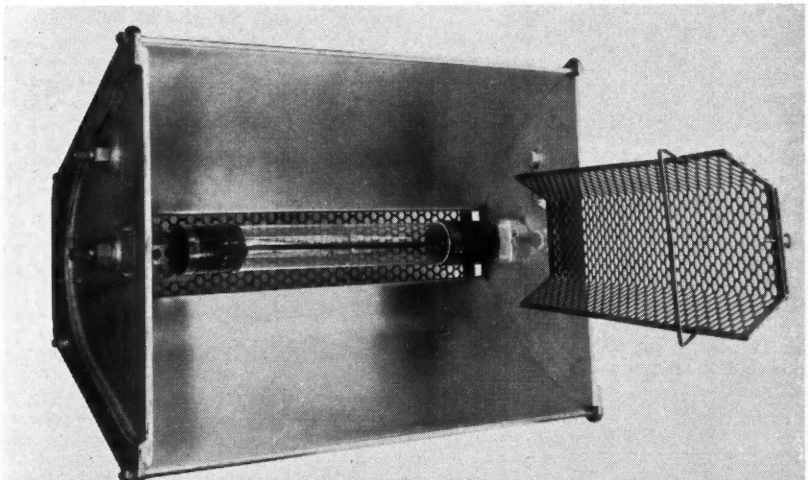
Vertical angle	Alloy. Candle power	Enamelled. Candle power
deg		
0	1,880	2,090
10	2,180	2,230
20	2,580	2,430
30	2,760	2,560
40	2,760	2,490
50	2,220	1,930
60	1,270	1,190
70	457	536
80	132	201
90	—	—

TABLE III.—AMERICAN REFLECTOR TESTS

Period	Porcelain enamelled		"Alzak" aluminium	
	Closed	Ventilated	Closed	Ventilated
Initial	100	100	100	100
After 9 weeks	67	98	68½	91
Units cleaned	100	100	100	100
After 2 weeks	83	100	85½	97
After 4 weeks	76	100	78	95
After 12 weeks	62	98	61	93

The only comments offered on Table III are the obvious ones : that steel vitreous-enamelled fittings wear better than anodized ones and that ventilated fittings, either by accident or design, tend to keep clean longer than non-ventilated fittings. There can be

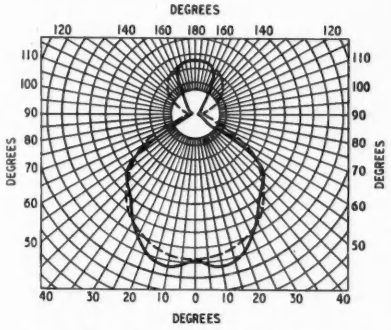
Recently developed 2.5 kW mercury lamp in new type of dispersive reflector. (*Courtesy B.T.H. Co.*)



no doubt that a fitting which keeps itself clean has a big advantage for, in spite of repeated entreaties by lamp and fittings manufacturers requesting efficient cleaning of reflectors, it is usually only sketchily carried out and gets no further than a hasty wipe with a cloth when a lamp is changed.

Simple Fixing Device

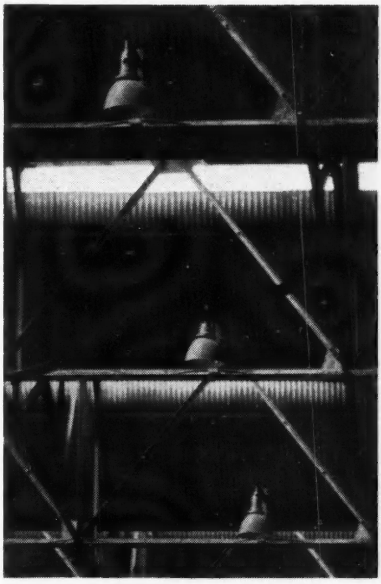
Those firms which do carry out efficient maintenance invariably use the overlamp type of reflector, although a very interesting plug suspension attachment which is worthy of mention was developed by the steel firm of Richard Thomas & Baldwins, Ltd. It consists of a three-pin plug and socket mounted in a box of special design that is screwed to fit in the top of the reflector and incorporates a hook which engages with the terminal loop of the suspension chain or conduit. By withdrawing the plug and unhooking the unit from the suspension loop



Polar curves of high-bay industrial reflector fitting

the whole fitting can be removed without disturbing the lamp. This system is very convenient from an installation point of view, as all the necessary wiring can first be carried out and the lighting fittings can be hooked on and connected up in seconds.

From the information available high-bay lighting resolves itself into a choice between a small number of high powered sources, or a larger number of comparatively low powered sources. The choice must depend upon local conditions. Where there are high obstruction articles, such as in the engine fitting shop of a shipbuilding firm, it is obviously not policy to depend upon high



Inverted L-shaped supports for high-bay lighting in steel strip rolling mill. (*Courtesy Stewarts & Lloyds, Ltd.*)

powered light sources spaced at long intervals as the workmen would be embarrassed by dense and large shadows caused by the obstructing machinery. At the same time where there is an unobstructed view with no impediment to the light flux, there is a very good argument in favour of high powered light sources spaced at greater distances.

A good example of the latter is the new installation being carried out at the South Wales Aluminium Co.'s factory at Resolven, South Wales. The system makes use of the 2½ kW mercury lamp developed by the B.T.H. Company, which is housed in a dispersive reflector developed jointly by the B.T.H. and Simplex Companies.

The lamp is run horizontally with magnetic deflection of the arc by an arc control lead. By the side of each lamp is a 1,500 W tungsten lamp which serves the dual purpose of correcting the colour of the resulting illumination and also furnishing supplementary light should there be a momentary interruption of the supply which extinguishes the mercury lamp.

Steel works lighting by fluorescent coated isothermal MAF/V lamps

The mounting height above floor level is 38ft 6in and a staggered 65ft by 48ft spacing is adopted ; 71 mercury 2½ kW fittings will be used in the installation, controlled in groups of three by triple-pole and neutral switch-fuses. The tungsten lighting is controlled by contactors with push buttons at intervals of about 200ft. Cables are in trunking fixed at high level and tubing is of aluminium between trunking and switching, and between busbars and lights.

The fitting is an anodized aluminium reflector with a diffusing surface, contained in cast aluminium end plates ; the top of the fitting is open for ventilation and it is reasonable to suppose that the convective air stream will tend to decrease the time spent on maintenance while the total number of lamps needed to illuminate a given area will be less than one-sixth of those on a comparable 400 W MA/V mercury scheme.

In contrast, a scheme employing comparatively smaller wattage light sources and at the same time covering a large area has been designed for the strip rolling mill of Stewarts & Lloyds, Ltd., where because of machine obstruction it is not possible to use large wide spaced sources. The general details of this scheme are: mounting height of fitting above floor 40ft, spacing 20ft by 30ft, number of fittings 93 of 1,000 W tungsten, 62 of 400 W mercury MA/V, illumination 7 to 8 lumens/sq ft. The mill is at present 960ft long and 100ft wide, but is being extended. An interesting feature of the scheme is the inverted "L" shaped supports, which raise the deep dispersive reflector to the level of the trusses in order to clear the travelling crane.

A third example is the main bay of the Lancashire & Corby Steel Manufacturing Co., Ltd., which is a beautifully planned scheme and the resultant illumination is so good that comment and criticism seem out of place. The 400 W fluorescent coated isothermal MAF/V lamps are mounted approximately 36ft 6in above the floor level. Yet this scheme could undoubtedly have been satisfactorily carried out with 1 kW or 2½ kW mercury lamps, had they been available at the time.

Household Illumination

Functional Lighting in the Home

By F. JACKSON*

IT is an interesting fact that most householders consider that they are competent lighting engineers. They thereby fail to recognize that there are many problems of illuminating engineering associated with the lighting of domestic premises whose solution is not readily obvious, even to a registered lighting engineer who has served a long apprenticeship to his profession.

Up to the beginning of the last decade for all practical purposes the colour of the light was limited to that of the tungsten filament lamp, perhaps modified by the use of tinted glassware, or by some other form of decorative fitting.

With the advent of the fluorescent lamp, however, the possibility of using coloured light exists and in any case several different near-white fluorescent lamps are already available on the market. No fluorescent lamp exactly matches in colour and in colour rendering properties the radiation from a tungsten filament lamp. For some purposes its colour may be more favourable than that of a tungsten filament lamp. For other purposes the reverse may apply. It is recognized, however, that we are at the beginning of a period of development which will undoubtedly include the extended use of fluorescent lamps for the lighting of domestic premises. They offer advantages, not only on account of their high efficiency, but also because of the comparatively low source brightness and the desirable shape of the source for many lighting purposes.

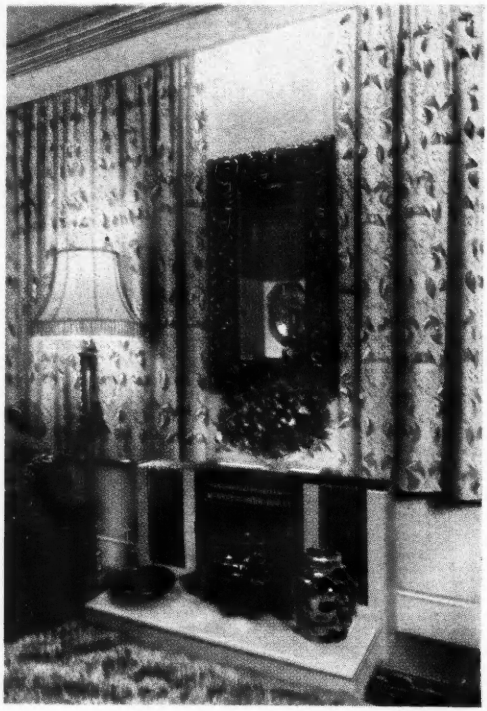
*Siemens Illuminating Engineering Laboratory, Preston.

A 40 W lamp in a totally enclosing fitting under the striped canopy lights the front entrance, both the underneath of the canopy and the door itself being painted white for light reflection

Nevertheless improvements continue to be made in the design of fittings for tungsten filament lamps, and by simple means it is possible to produce marked improvement of the illumination of domestic premises by wiser application of these well tried sources of light.

The industrialist has long since recognized the need for good lighting in the manufacturing departments. He has realized that the efficiency of his works depends to a large extent on the ability of his workers to see the job in hand clearly and under conditions which result in the minimum of fatigue. When the worker reaches home, however, it is all too often true that he finds illumination levels and general seeing conditions much inferior to those to which he is accustomed at his place of business.

It is very probable that the lighting installation in the workroom was designed by an illuminating engineer, but how seldom is this the case with home lighting. It cannot, therefore, be stressed too often that the design of lighting installations,



Soft light on the mirror from a lamp under the pelmet and another beneath the glass panel in the fire surround helps to create a focal point in the room and increases its decorative appeal while the floor standard shade has a white lining and is of generous proportions with an open top

whether in the factory or the home, should be the concern of a trained illuminating engineer. In this connection it must be remembered, too, that many of the considerations cannot be dealt with in terms of quantities for the quality of the lighting is all important in most rooms of a house. The pastel shades and the more dominant hues of the furnishings may be ruined if the combination of lamp and fitting emits light of an unsatisfactory colour. At the same time attention must be paid to the proper placing of the sources of light so that good modelling of the architectural features, or the furnishings, of the room is obtained to produce an effect which is both satisfying and adequate.

Lighting in the home may be considered under two general headings, functional lighting and lighting for effect and atmosphere. There is no sharp line of demarcation between these two general aspects for one cannot deal with one without trespassing to some extent on the other. The utilitarian lighting must provide a level of illumination sufficient for the visual task without glare or discomfort and the lighting for effect can do much to make the house a home and a place of rest and recreation.

This article is, however, primarily concerned with functional lighting so let us consider each of the main sections of the house in turn.

In the porch our task is well defined. We must illuminate our visitor and ourselves so that each can see the other, even though the visitor has just left the darkened street and we have just emerged from a well-lit room. We require a low surface brightness source in order to reduce so far as is possible the contrast between the outdoor conditions and those to which the eye must adapt itself when the visitor enters the house. A single fitting is generally sufficient to illuminate both the householder and the visitor on the threshold. This fitting may be exposed to the weather and, among other things, must be robust and durable. It may be noted that in our illustration the step is well defined by contrast.

The hall is more generally a place where full effect can be given to the beautifying effect of light. Most of us can remove our coats and hats in the dark, but some welcoming light is desirable and the opportunity exists to use fittings of a decorative nature.

In the dining room and kitchen our task becomes more complicated. We require a high illumination level properly directed and of the right colour because food to be appetizing must be illuminated by light of the correct colour. The housewife must have her kitchen lights so positioned that she can see into the oven, on to her shelves and into her utensils. Often it is not possible for one lamp or fitting to accomplish all these tasks, but in a small kitchen it is seldom necessary to use more than two lighting points.

The pantry and the cooker have each their local fittings, but the fitting below the high cupboard may appear extravagant

to some. It is important to remember that more perhaps than in any other room the fittings used in the kitchen must be easy to clean. Fortunately designs employing filament or fluorescent lamps are readily available and the latter are undoubtedly pre-eminently suitable for kitchen lighting.

In the dining room the visual task is largely centred around the table and it is the table surface that we must principally illuminate. The 150 W tungsten filament spotlamp in a suitable louvred ring fitting is an ideal source for the illumination of the dining table. Fluorescent fittings associated with tungsten filament

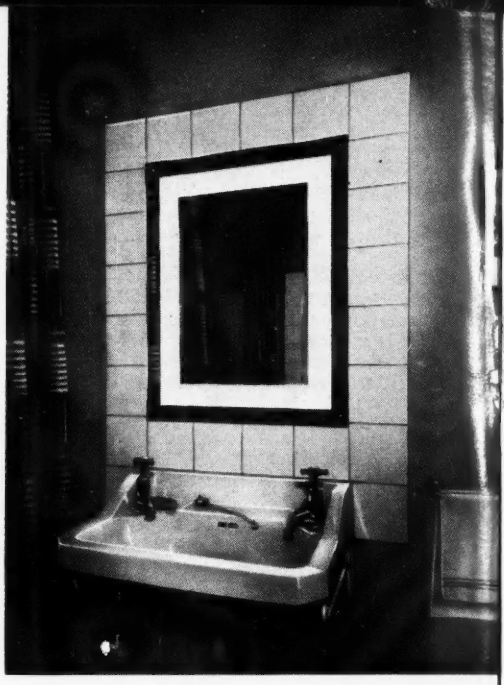
Glass cupboard with a 3-ft fluorescent lamp beneath opal glass in the base which also illuminates the alcove below ; this could be applied to either a working surface or a service hatch ; glass bricks might be similarly used to admit natural light during the day

Good shadowless lighting is a necessity in the kitchen and an automatic larder door switch will minimize current wastage

lamps are also very suitable. Here again a louvred fitting reducing the brightness in unwanted directions is almost ideal.

The lounge in many homes has to serve as a general purpose room and the lighting need has, therefore, to be carefully assessed. A relatively high illumination level is necessary for the homely tasks of knitting and sewing and, of course, for darning and other repair work of a similar nature. In general, for these exacting visual tasks the necessary high illumination level may be provided by local lights while the general lighting can come from one or more low brightness fittings or from fluorescent lamps concealed behind a curtain pelmet or in a specially prepared cornice moulding.

The stairs and landing require sufficient light to make them safe and here it is most important to properly place the sources of light. It is generally good practice to illuminate the treads of the stairs and to leave the risers in shadow. The steps are thus made clearly visible by contrast. The effect is well illustrated by the step into the porch of the house. If fluorescent lighting is used, the source should preferably be placed parallel to the stair treads and it is very desirable for the instant start circuit to be used.



Lighting the shaving mirror with low wattage filament lamps spaced evenly behind the opal glass strip surround ensures that there will be no shadows on the face and that the heat from the lamps will prevent the mirror steaming over

The bathroom requires special attention. The general lighting fitting must be large in relation to the lumen output of the lamp as a high brightness source will produce multiple reflections from the many polished surfaces met with in the bathroom. Some local lighting near the shaving mirror is a very desirable addition and here again, as this must practically always be in the line of vision, a low surface brightness is advisable.

The bedroom should have a fairly low illumination, but with additional local lighting at the bedhead and around the dressing table. The colour of the lamps should be such as to suggest a warm and tranquil atmosphere. In large wardrobes small wattage lamps operated by door switches are advantageous and economical. In a de luxe arrangement the provision of fluorescent lights at the dressing table with a change over switch to give light of daylight quality and, alternatively, warm light will greatly assist the lady of the house in preparing for either out of doors or for an inside event. The "natural" and "mellow" fluorescent lamps are very suitable for these alternative functions.

In conclusion it is perhaps not inappropriate to mention one example of lighting for effect. The alcove illustration shows the effect of specialized lighting in relation to display. There is much opportunity for effects of this kind as additions to utilitarian lighting.

It is important that all lighting, whether for effect or for utilitarian purposes, should be neither too complicated nor too obvious. Good home lighting should be unobtrusive and, ideally, it should pass almost unnoticed. The job of home lighting is one requiring specialized knowledge and science and art should be happily combined if the result is to be satisfying.

Decorative Features in the Home

Blending Style with Surroundings

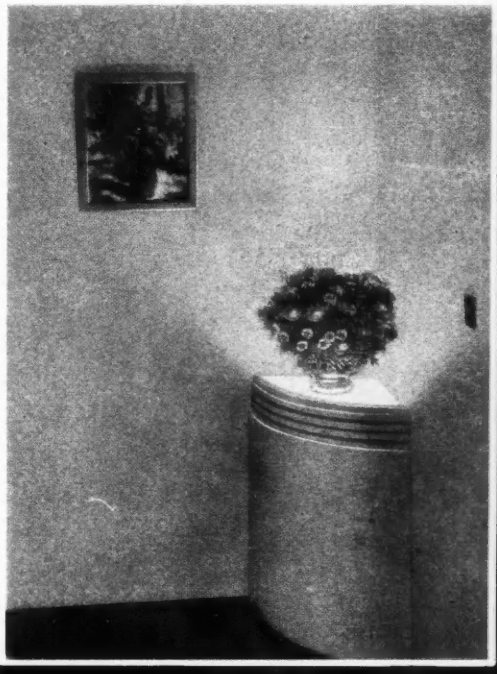
By L. E. A. PHILLIPS*

WHEN choosing a lighting fitting the aim should be to find a style that blends closely with its surroundings. A well-chosen fitting ceases to claim notice otherwise than as part of the decorative scheme of the room a short time after it is installed. In contrast thereto a decorative lighting feature is specifically designed to invite attention. Its primary purpose is to add to the decoration of the room, whereas a decorative lighting fitting is decorative only incidentally to its main function of providing light for visual tasks. The decorative lighting feature is not seasonal in its appeal, being equally attractive in summer as in winter.

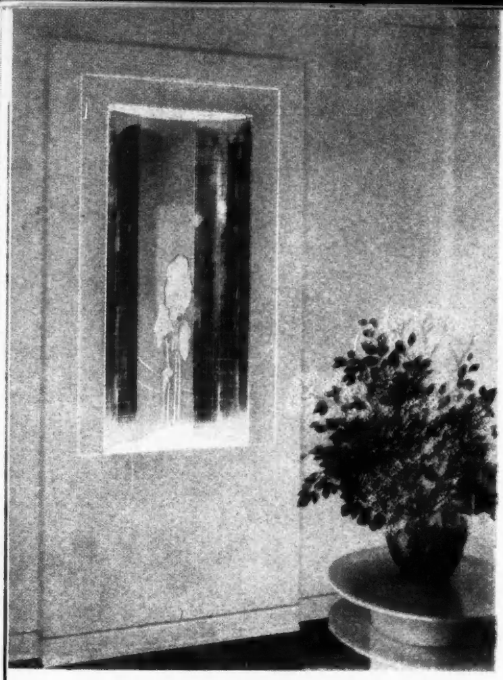
Lighting features, being mounted in the normal field of view, afford wide scope for individual taste and expression in their creation. Whether they are to be installed in a large house or in a more modest dwelling, the designer should remember that they are primarily architectural in character and, therefore, must blend with the proportions of their surroundings so that a sense of balance is maintained. Over-emphasis in any direction must be avoided if the effect is not to be unduly dramatic.

A plinth light such as that illustrated is probably the simplest form of decorative lighting feature, requiring no structural alterations to the room

Portable corner fitment with top of diffusing glass



*Manager, Fittings Design Office, General Electric Co., Ltd.



The more effective features are usually built in, so that it is preferable, though not always essential, to consider their installation at the initial planning stage of building when the architect and decorative lighting specialist can be consulted and provision made for them in the structure. If this is done, the addition to overall building costs is usually very small. In existing buildings, any cutting away necessary to form recesses or apertures is generally of a minor nature and here again costs should be quite reasonable.

Fortunately it is not always necessary to modify the building structure, as there are many devices which give very pleasing effects by building on, or building out, rather than building in.

Recessed wall feature with "Mirroflex" sides and central peach mirror panel with engraved design ; the lamps, covered by a diffusing glass panel, are in the base

Curtains may be lighted by filament or fluorescent lamps behind a pelmet

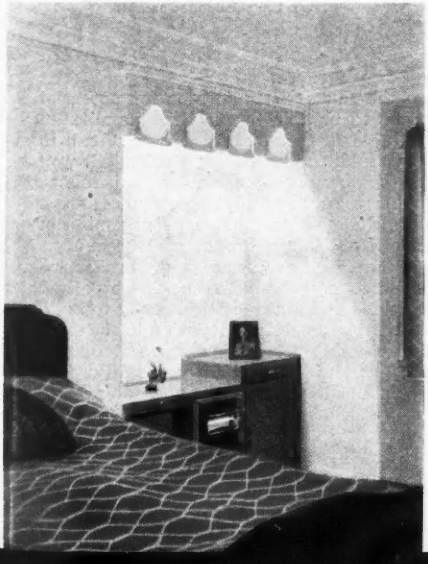
One example of a feature that requires no structural alterations to the room is the plinth light. This is probably the simplest form of decorative lighting feature. A feature that, although portable, may be regarded as a permanent part of the architecture, but not involving any structural change, is the corner fitment which contains a lamp and has a top of diffusing glass.

Other suggestions of a similar kind are illuminated panels built into tables, cabinets, pedestals and so on. A variation of the corner fitment would be a low corner cupboard with a glazed luminous top ; or a corner cupboard taken to ceiling height, the upper part incorporating a recessed feature. Existing cupboard doors sometimes provide opportunities for utilizing a built-in feature without structural alterations to the house.

Pelmets for curtain lighting, or to provide concealed illumination of existing recesses are another means of introducing decorative features in a room without making structural changes. Perhaps the simplest scheme of all in this category, however, is to mount lamps of suitable type and wattage on the back of selected items of furniture, such as sideboards, bookcases and long-case clocks. These items should be stood a few feet from the wall, the resultant effect being to create a pleasant background glow in a colour to suit individual surroundings. Sometimes a fireplace surround can be utilized as a decorative feature, concealed lamps being used to give a cheerful glow in this otherwise vacant space when heating is not required.

Luminous fireplace feature with a clock incorporated and peach mirror centre panel, engraved with figure, a tubular lamp being concealed by the mirror

An existing recess lighted by lamps behind a decorative pelmet in painted timber with engraved glass diffusing panels



The recesses of built-in features may be quite plain, in the form of a simple niche, on the sill of which suitable ornaments may be placed ; or the recess may be lined with decorative glass, the centre panel carrying the principal motif.

The features described and illustrated, with the exception of cornice lighting, are all economical in the consumption of electricity, requiring lamps of relatively low wattage, the light output of which can be fully utilized by the use of suitable reflectors and reflecting surfaces.

Fluorescent lamps, available in a wide range of sizes and colours, added to the

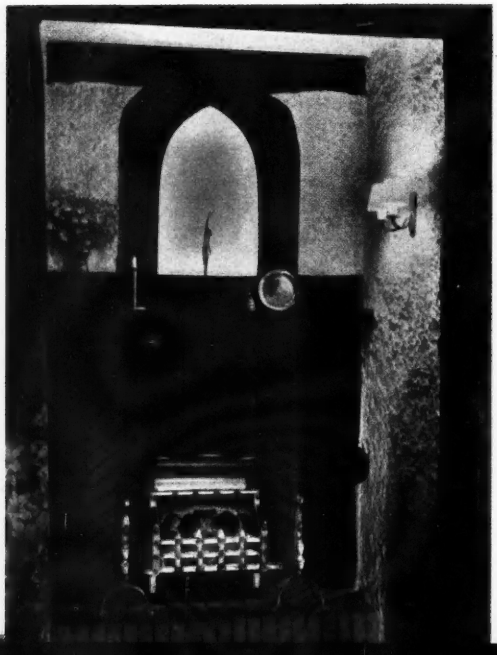
variety of filament lamps in bulb and tubular forms and to the silvered bulb reflector lamp, are ample basic light sources for decorative lighting features. Care should be exercised in the use of coloured light. In general, bright or vivid colours should be avoided as otherwise the resulting effect is likely to be theatrical.

It is difficult to make an adequate impression by means of descriptions and photographs of the luminosity and the subtle effects of light and shade that can be achieved. Readers, whose interest in the subject has been stimulated, will find further valuable suggestions and information in a booklet on home lighting published by the E.L.M.A. Lighting Service Bureau, the aim of which is to promote the full and proper use of light in the service of the community. Coming together and exchanging views will not only be mutually beneficial, but will also enable each to make a contribution that will help both.

This form of lighting offers a wide and expanding field for electrical traders. To exploit it to the full, it is important for potential users to be able to examine examples of suitable features. Portable and built-in devices of the types described might well be displayed in electricity showrooms, lighting sections of department stores, furnishing showrooms and the premises of electrical dealers throughout the country.

Manufacturers specializing in decorative lighting are able to supply any of the features at suitable notice, ready to build into prepared accommodation in the same way as inset electric fires, and experienced designers are available to give advice on the subject.

Cornice suitable for fluorescent or metal filament lamps, the soffit being also luminous for effective wall illumination



Built-in recessed niche above a fireplace with lamps concealed in the base

"Rosslyn Hill"

The Lighting of a Virginia Water Residence

By RAYMOND BERRY*

THIS house of medium size, when purchased by me recently, like many of its type built some fifteen years ago, was only sparsely equipped with lighting points. They were haphazardly placed so that good lighting from the efficiency aspect as well as that of decorative effect was an impossibility.

When re-wiring the house the aim was to achieve both these objects and to attain through the medium of light an atmosphere of warmth and comfort. Yet another object, no less important, was to use the lighting medium to enhance the beauty of furniture and furnishings by night.

The accompanying illustrations will indicate that traditional methods have been employed, since the construction of the house offered little scope for the employment of architectural or concealed forms of illumination.

In the living rooms, the fittings and shades have been chosen so as to blend with the general decorative scheme, to provide a sense of light and shade and, at the same time, to ensure sufficient local concentration of light where it is required.

In the lounge, part of which is illus-

* *Managing Director, Berry's Electric, Ltd.*

Part view of lounge which is uniformly illuminated by wall brackets and floor standards

trated to show the door leading on to the terrace overlooking the garden, uniform lighting throughout the room is obtained when all the fittings are switched on. Softer and more subdued effects can be achieved by using only floor standards and table lamps, without altering the general balance of light. In this room the walls are cream distempered and the curtains and carpet of pale colour. The furniture is upholstered in damask and velvet of pastel shades and the fireplace is of oatmeal stone. The shades are a golden beige damask to give warmth to the walls and furnishings with the minimum loss of lighting efficiency.

In the dining room, overhead lighting is usually desirable, so a five-light Georgian pendant of butler's silver is used. It has matching wall brackets. The shades are soft pink silk to impart warmth to the delicate hue of the papered walls and light carpet. The built-in glass shelves are illuminated from top and bottom by "strip" lamps, the natural beauty of the Venetian glass being enhanced in this way. An added attraction on a side table is a flower bowl with illuminated plinth. A floor standard in the bay window enriches the colour of the Regency curtains.

The furnishings of the principal bedrooms are chintz against a background of white Indian rugs and cream distempered walls. The light sources are positioned where they are required, the individual points being switch-controlled both from the bedside and the door.

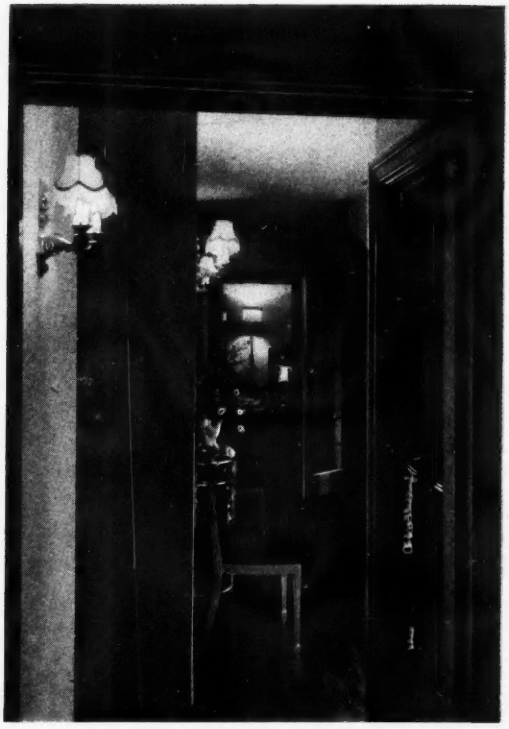
In the bedrooms, matched damask lampshades are used in tone with the main glazed chintz colour schemes, but providing a warm light and a general atmosphere of luxurious comfort without extravagance.

Whereas the accent of the lighting of

In the dining room are wall brackets matching the Georgian centre pendant with a glass high light in one corner

See opposite page. Top : **Matched damask shades tone with the bright bedroom fabrics, switched from bedside and door.** *Below :* **Plug-in lamps provide light where it is required without interfering with two-way switching**

Small wall brackets against light-coloured decorations brighten the entrance hall



the living rooms and bed rooms is on comfort and decorative appeal rather than on extreme efficiency, the domestic offices and bathrooms are more strongly, but evenly, lighted by flush-fitting ceiling half-spheres, together with illuminated mirrors and other locally placed wall brackets at working positions. In both the day and night nurseries especial care has been exercised in the positioning of lighting fittings so that they shall be well out of reach of inquisitive little fingers.

The lighting of this eight-room residence accounts for some 4 kW of the 30 kW total load, including such home laundry appliances as a Bendix clothes washer; Belling drying cabinet and Hotpoint ironer as well as a Berry under-sink water heater, G.E.C. refrigerator, Kenwood food mixer and similar kitchen aids to be added as needed. Outlets and circuit layouts have been arranged with due regard for future requirements.

SOUND FILM EQUIPMENT

TWENTY-ONE years ago, on 8th December, 1929, the Globe Cinema, Coventry, equipped with B.T.H. 35-mm sound film equipment, opened to the public with the film "White Cargo." This was the first public exhibition to be made using B.T.H. equipment although private demonstrations had been given a year previously at the London Palladium. The opening of the Globe Cinema was completely successful and was followed by others so that by the end of 1937 B.T.H. equipment was installed in over 1,000 cinemas throughout the country, and to-day there are many more.

The equipment at the Globe Cinema was suitable for the reproduction of sound from film, or sound from synchronized long-playing gramophone discs. The amplifier had an output of 40 W and was all-mains operated, whereas competitive equipment, mostly of American origin, used large dry batteries for the amplifier h.t. supply. It was the first all-mains equipment to be installed in this country and as such represented an important technical advance in equipment design.

Since that time the company has been concerned with many developments and improvements in the design of projection equipment and film apparatus. At present consideration is being given to the technical problems involved in the use of large screen television in the cinema. In addition, the company is working on ideas to improve the projection of films in the cinema. In 1951 it will show some of its latest ideas on projection in the Telecinema of the Festival of Britain for which B.T.H. film projection equipment has been selected.

Decorative Lighting

"The Complete Scheme"

By H. C. B. WOODCOCK*

THE concept of light as a medium for creative design has in recent years made some, although regrettably small, progress. The lighting designer is now an established entity, one who does not require technical knowledge of illuminating engineering, but who does know something of the principles of good design. The design of treatment of any space must first be considered in its entirety. Light must be treated as a basic "material" to be housed in the complete scheme in the same way as the decorations, architectural features, furnishings, etc. Colour treatment, illusions of height and width, display focus, are only a few of the contributions made by light. Good lighting schemes are inconspicuous by their presence and yet the number of shops, showrooms and public buildings where the

*Manager, Harris & Sheldon, Ltd. ,Birmingham.

The Orchard Restaurant in Cardiff with 8 to 10 ft.-candles of illumination

A showroom in Birmingham with 35 ft-candles of light

lighting falls into this category is extremely limited.

It is an undisputed fact that if a space, or department, be illuminated by a pleasant and attractive glow from an inconspicuous source, with emphasis-lighting on points of interest, the feeling conveyed to the observer will be one of pleasant well-being in a bright and cheerful atmosphere. This is true of good lighting under any set of conditions. Light for the sake of lighting should never be disassociated from the psychological aspect of the scheme. A comfortable 10 foot-candles will induce far more output from the worker than a meaningless 35; similarly, the discerning customer will be more inclined to satisfy his material requirements if the general atmosphere is attractive rather than purely functional. In our complete schemes, therefore, we should ask ourselves, not what fixtures or fittings can we buy for so much money, but what can we do with light to make this or that place more liveable; what human wants can light fulfil to make this place more desirable.

In America, mainly through freedom from restrictions in immediate post-war years, intimate lighting has been more fully developed and any concern of consequence carries its staff of lighting designers. Nevertheless, too great an emphasis is still laid on the functional aspect of the scheme. For example, the "eggcrate" ceiling is a great step forward, but even that ceases to serve any purpose once the observer is immediately below it; the loss of efficiency caused by obscured glazing above the louvre apparently is considered to outweigh the advantages of a fully diffused and almost invisible light source.

It has been stated that one need not be

a lighting engineer to design lighting schemes. This is now a proven fact, but once the scheme has been conceived, the engineer comes into his own. He will endeavour to make practicable the designers' ideas, but the engineer should never attempt to modify the design in favour of purely mechanical or electrical considerations of efficiency, consumption, installation difficulties, etc.; equipment must be adapted to serve new purposes or manufactured to fulfil the requirements. Ingenuity and enterprise can overcome all obstacles.

In stressing the proper consideration to be given to light as a medium to be considered as one of the basic requirements of any complete scheme, the contracts calling for a straightforward treatment must not be overlooked. Lighting fittings carefully chosen to blend into the scheme must undoubtedly take their proper place. They must, however, I repeat must, always bear a sense of relationship to the scheme as a whole and preserve that even balance without which all our efforts are futile.

We may see concerns offering standard lines which, it is claimed, can be fitted into any scheme. If our customers are so easily satisfied as to require the commonplace without thought about the consequence, let us rather guide the inquiry into channels aimed at furthering the ideals of good lighting rather than adopt "From the Shelf to the Ceiling" as our motto.

Lighting has been, and in many instances still is, a question of what or whose fittings can be added after the proprietor or architect has decided how much money is left to serve this purpose. The advent of the lighting designer, treating all his materials in their true perspectives, is doing much to overcome this unfortunate outlook. Much could be said of the efforts of some quite reputable concerns, to foist current production of quite unsuitable equipment on to a credulous public, of civic buildings now shuddering under the weight of industrial trough units, of stores in which fine merchandise is rivalled only by row upon row of fluorescent lamps, of churches equipped with so much "daylight" fluorescent as to resemble the inside of a public mortuary. Night has been converted into day, soft shadows have disappeared and, in exchange, we are offered a meaningless blaze of cold comfort.

The illustrations are not claimed to be perfection in themselves, but they do show that an attempt has been made to preserve a balance between lighting, decorating and architectural features. Standard equipment has been used in its original form, or adapted to meet the requirements of the scheme.

Real progress will only be made when the design office is divorced from the conveyor belt and in the re-building of our cities we can but strive to attain to conditions in which all factors contributing to man's well-being are given their true and proper places.

Commercial Premises

Attuning Background to the Occasion

By W. H. SEWARD*

WITH the passing years there has been a fresh approach to artificial lighting which has stimulated those directly concerned to begin to consider, in addition to the quantity of illumination for any particular purpose, both its quality and effect. This trend was hastened by the appearance of the fluorescent lamp which is both a larger and more uniform source as well as a more subtle blender of colour.

The pioneers had earlier, and rightly, pointed out that these two factors are by no means the only ones needing consideration when trying to obtain both good visibility and to create a desired

*Sales Manager, Aish & Co., Ltd., Bournemouth.

atmosphere. However, the fact that the newer light sources have these two inherent properties hastens the decline of those who formerly considered solely "the lumens on the working plane," together with those devoted exclusively to the outward appearance of fittings.

This leads inevitably to a new conception of the lighting art, involving a balanced assessment of intensity, colour and contrast interrelated with consideration of the shape and decoration of the space to be illuminated, the methods to be employed, and the effect to be obtained. Properly applied these combine to create a composite three-dimensional impression which, though sensed by the layman, is never forcibly brought to his attention.

Among the less obvious places where this new approach to lighting may be used to advantage are the public offices of such large commercial concerns as banks, insurance companies, building societies and public utility boards. Here such concerns meet their clientele and carry out the routine clerical activities of their services. The impression to be conveyed is doubtless that of complete reliability and efficient attention to the customers' interests. This is achieved in large measure by the personnel performing their sometimes complicated duties with unruffled calm, but no player can give his best performance if the background is not attuned to the occasion. Common usage has made the accepted lighting installation for such offices a military formation of totally-enclosed, diffusing glass, pendant fittings reinforced with green-shaded desk lights as necessary. It is debatable, in many instances, whether this array provides even an adequate quantity of illumination and it is certain that very little is achieved by way of creating an effective background.

In contrast thereto are the bank fittings illustrated, which were made by Allom Brothers, Ltd., to the design and instructions of the architects, W. Curtis Green, R.A., Son & Lloyd, of London. Each consists of three 4 ft 40 W hot-cathode "natural white" fluorescent tubes with

Combination of hot-cathode fluorescent tubes with tungsten filament bulbs in the cashier's hall of a bank

South coast showroom of a Gas Board lighted entirely by cold-cathode fluorescent tubes in louvred fittings

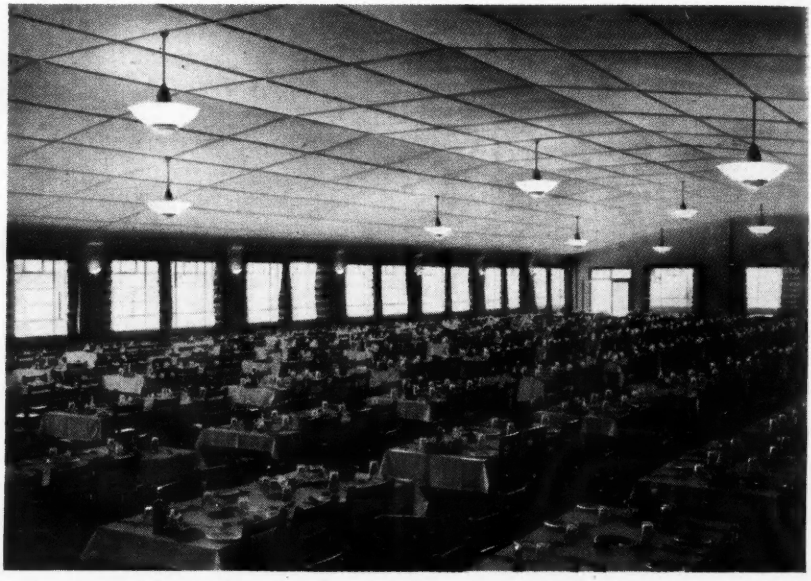
control gear concealed in the indirect bowl, which also contains three 150 W tungsten lamps with reflectors; a tungsten lamp in the pendant bell provides downward light.

In general a fairly high intensity of illumination will be required to best serve the interests of all parties and pronounced contrasts are to be avoided. It is most desirable that the light sources should be well above the normal line of vision; where this is not possible, owing to low ceiling height combined with exaggerated length or width, it will be found that a louvred type of fitting has advantages. The "natural white" lamp alone is not suitable for this purpose and where the installation is to operate at mains voltage a combination of tungsten and fluorescent lamps is a practical compromise.

The public offices of certain of the public utility boards combine the function of certain routine clerical work with that of the display and sale of equipment. Here a measure of display lighting technique will be necessary and higher contrasts of illumination will be acceptable to direct attention to the equipment displayed. The fittings illustrated were planned by Aish & Co. in conjunction with the G.E.C. Variation in colour may also be used in this connection, but it should be applied with the greatest discretion as it may tend to create an unreal impression of the equipment, leading to disillusion and dissatisfaction when viewed in more natural surroundings.

It cannot be too strongly emphasized that the success of any particular scheme can only result from the careful co-operation of all parties concerned with internal decoration and furnishing. Economic and practical considerations greatly limit the range of lighting equipment available for any one set of conditions, making such co-operation more than ever necessary if the best results are to be obtained.

Finally, since we speak of lighting as an "art," we must expect that no two people will agree about the degree of success an installation achieves.



The dining room, Maddieson Holiday Camp, near Great Yarmouth, equipped with Ediswan "Harcourt" 26-in dia louvred glass bowl fittings tinted pink with half bowl wall brackets to match and (below) the ballroom at the same camp equipped with eight 36-in dia 16-light double corona fittings, finished gilt with suspended cream "Perspex" panels and multi-coloured centre cone, accommodating lamps for upward coloured lighting

PENDANTS

Some Modern Styles

THE combination of cast bronze metalwork with "Perspex" has resulted in diffusing fittings of "form and stability," ensuring both comfort and a bright atmosphere. The employment of period electroliers with tungsten lamps is still favoured for interiors of traditional design and the way they are being dealt with by the Edison Electric Co., Ltd., enables the soft light and shade together with the decorative metalwork to harmonize with the designed character of the interiors.

In more modern buildings in which it is desired that decorative tungsten filament light be employed, the semi-indirect form is still favoured. This need can be satisfied by the provision of pendant bowl fittings with tinted glass, the design of which can be varied to suit most tastes.

One method of introducing the modernistic touch within this range is to fit a louvre at the base of the bowl which will, additionally, increase the downward lighting component without detracting from the overall general appearance of the fitting which its designer intends it to present when installed in the surroundings for which it is made.

Twin 5 ft Ediswan "Harcourt" fluorescent pendants with tinted "Perspex" top panels, obscured bottom panel and the ornamental end grilles backed and tinted to match. (*Photo : Scottish Studios, Glasgow*)

Public Buildings

Reversal of Lighting Outlook

By D. L. TABRAHAM,* M.A., F.I.E.S.

IT is proposed to consider as public buildings, those in the interiors of which lighting is used not only to create good visual conditions, but also to reveal beauty, to blend with the architectural theme or to create "atmosphere". Into this category, therefore, fall not only churches, town halls, and buildings of historic interest and architectural value, but also banks and offices, restaurants, hotels, concert halls and theatres, pleasure halls and the like.

Such buildings in the past were lighted almost entirely by tungsten filament lamps, but a review of installations carried out in recent years shows a striking growth in popularity of fluorescent lighting. On the whole this is a sensible trend which should be encouraged, although by no means to the complete exclusion of tungsten lighting. Some of the properties which established fluorescent lighting for industrial premises were the economic advantage which so often accrues from their high efficiency and long life, the low surface brightness which reduces glare, the highly diffused light which lessens unwanted shadows, the small heat output and the invigorating colour. These same properties are equally valuable in the lighting of public buildings, but during the war fluorescent lighting had, to many minds, become so closely identified with industrial reflectors that it was hard to believe it could be suitable for use in more decorative interiors.

Two post-war developments have done much to reverse this outlook. First, the range of mains voltage fluorescent lamps has been extended to include not only ratings from 1½ ft 15 W to 8 ft 125 W, but also a choice of five general lighting colours, of which "mellow," the most recent addition, was developed specially for social use. Secondly, designers have been able to show that fittings need not be confined to the somewhat austere lines of the trough reflector, but can be of pleasing appearance and made to conform to traditional design.

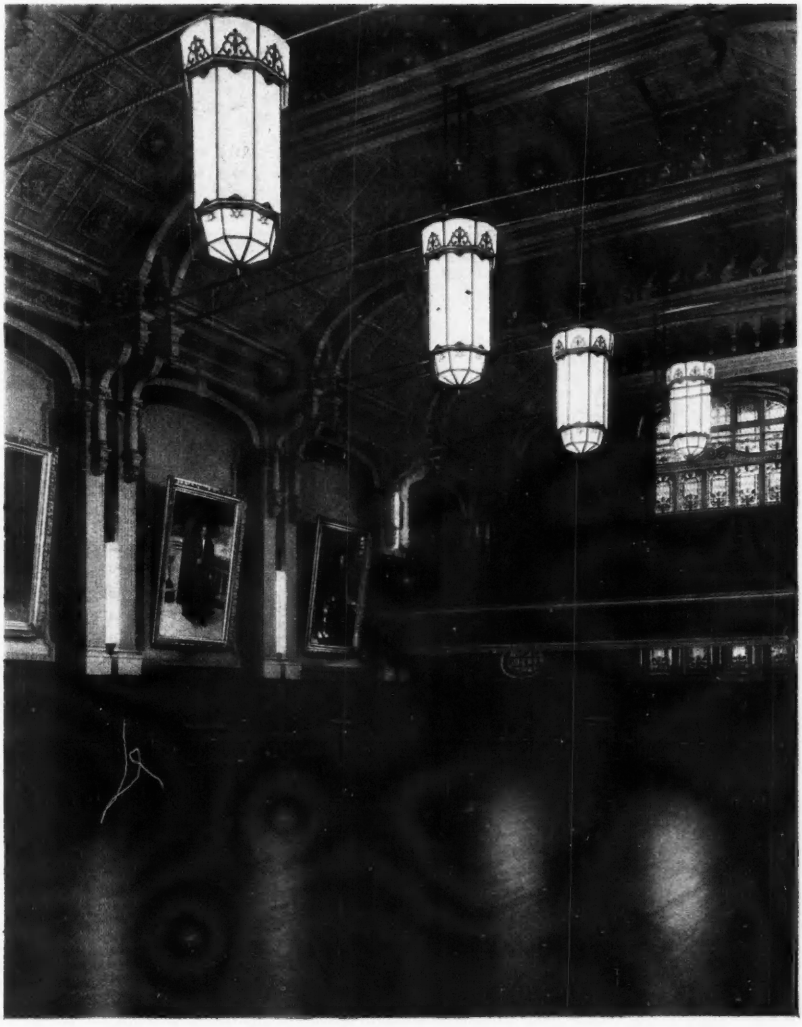
In the Chatham Town Hall are excellent examples of fluorescent fittings designed to harmonize with a traditional interior characterized by its richly decorative ceiling, panelling, carved wood and plasterwork. The pendants in the main hall each house ten 80 W 5 ft fluorescent lamps with auxiliary gear and are of gilt metalwork glazed with champagne flashed opal glass.

The fittings installed on the Quarter Deck of Dartmouth Naval College, designed to be reminiscent of old poop lanterns, are a further convincing example of what can be done in this direction. Each pendant contains twelve 3 ft 30 W lamps and each bracket houses six 2 ft 40 W lamps, both with metalwork finished black bronze and glazed with champagne tinted glass.

Mains voltage fluorescent lamps, however, are not by themselves the solution to every problem. When concerned with the appearance of food and of ladies' dresses and complexions one can rely on the tungsten filament lamp with its excess of red rays, and it may not be inappropriate to remind ourselves that first-class lighting can be provided with the filament lamp. A recent installation bearing this out to the full may be seen at the Connaught Rooms, London, where the general lighting in the Grand Hall is provided by four pendant fittings designed to conform with the architecture of the room, supplemented by lighting from cornices and wall brackets; each window is lighted by five 500 W reflector units. Again, for smaller restaurants or rooms where soft intimate lighting is appropriate, it is doubtful if fittings of graceful design incorporating shaded filament lamps will ever be superseded either as decorative features in themselves or for the effect they produce.

Long experience of filament lamps has given us a definite bias in favour of a warm

*Lighting Department, General Electric Co., Ltd.



Fluorescent fittings designed to harmonize with the richly decorative interior of Chatham Town Hall

light for social purposes, so when it is desired to make use of the high efficiency and other properties of fluorescent lighting for such purposes, a colour, such as " mellow," should be used ; alternatively, there may be a case for using cold-cathode lamps. The advantage of the latter, which is of special value here, is that neon-filled lamps are available giving a rich warm pink or gold light which, when suitably blended with the light from mercury filled lamps, is always kind to the

complexion while the appearance of food and fabric is eminently satisfactory.

The dining saloon in the Canadian Pacific liner *Empress of Scotland* is lighted by a combination of gold and ivory cold-cathode lamps in three tiers of continuous cornices with white flashed opal glazing. Table lamps are a tradition in this particular restaurant where they are removed for luncheon, but are always in use at dinner and in an installation of this type delightful effects can often be obtained by running the gold tubes only in some of the cornices, the tables thus standing out in a room flooded with a soft gold light.

Another very suitable method of combining tungsten and fluorescent lighting in restaurants and lounges is to use a few chandeliers of period or good contemporary design in conjunction with indirect or concealed fluorescent lamps in cornices or behind architectural features. By this means, the chandeliers, if of appropriate design, will add dignity and charm to the unobtrusive efficiency of the fluorescent lighting.

Even allowing for the low surface brightness of fluorescent lamps, some form of screening by diffusing "Perspex," or glass, or by louvres, is strongly recommended, especially when they are against a dark background or mounted near to eye level. An exception to this rule, however, may be found where an atmosphere of gaiety and lightheartedness is called for, which may best be produced by the use of bright colours and gay patterns. In such a case one may set out deliberately to catch the eye and unscreened lamps may be desirable. Coloured hot-cathode lamps, available in red, blue, green and yellow, may be used; or cold-cathode lamps, available in a wide range of bright colours, can be shaped to suit any architectural form.

Special feature fittings incorporating unscreened fluorescent lamps are often used to good effect in such places as cocktail bars. The Kursaal at Southend is an example of what can be done on a larger scale; the four 2-ft square pillars in the entrance hall are evenly lighted from inside by vertical flame colour lamps, one lamp illuminating each face, the light being diffused by reeded panels. Four decorative ceiling features are placed round the outside of the hall, each with two shaped lamps forming concentric loops, one gold and one sky blue, while the perimeter itself

Fittings based on the poop lanterns of old-time ships are used for fluorescent lighting on the quarter deck of the Royal Naval College, Dartmouth

Fittings for filament lamps in the Grand Hall of the Connaught Rooms, London, with supplementary lamps in cornices and wall brackets

is lined with continuous lengths of red and green lamps. The amusement arcade is lighted by a triple line of lamps, comprising a central blue flanked by gold on each side. This combination was chosen to produce a light, yet warm, effect which makes the arcade a cheerful place on the dullest of days. In this installation the turned back electrode, possible with cold-cathode lamps, is employed so that the lighting lengths appear continuous and form a decorative feature in full view from the floor.

If fittings in public and historic buildings are to blend with the architecture and decoration, skilled planning and design are necessary, for they must be of good appearance and correct proportion. To satisfy these requirements when using fluorescent lamps may necessitate, as in the case of Chatham Town Hall, the use of vertically mounted lamps. In a lofty hall, this arrangement enhances the value of the vertical architectural features and will aid full appreciation of mural decoration ; but, if the wall surfaces are dark in tone and where glazing predominates, the proportion of the light output of the lamp which reaches the floor is inevitably reduced, so great care is necessary to ensure an adequate level of illumination below. It is important to remember that no matter how decorative or historic an interior may be, the lighting, while blending with its surroundings, must also produce a level of illumination appropriate to the purpose of the building.

The size of pendants to suit such an interior is fortunately large, affording the designer the opportunity of incorporating inconspicuously auxiliary reflectors carrying filament lamps and designed to throw a concentrated beam downward, thus augmenting the illumination at floor level where desirable. The blended light thus

Tiered cornices containing gold and ivory lamps in the dining saloon of a Canadian Pacific liner

Fittings at the head office of the Midland Bank, Ltd., contain specially shaped sections of cold-cathode lamps and bowls adapted from the previous tungsten installation

produced is pleasant and can be most effective. To illuminate a fine ceiling, upward auxiliary lighting may equally well be provided from large pendants by similar means. A further possibility is to use decorative lanterns housing fluorescent lamps only, combined with high wattage tungsten lamps in projectors concealed by careful positioning close to pillars, beams, or reveals.

In public buildings lighting units are often of necessity installed in very inaccessible positions. This fact may strongly influence the choice of lighting, since lamp life largely determines maintenance costs, particularly in extreme cases in which the erection of special scaffolding may be necessary to enable lamps to be reached. The cost of labour involved in changing lamps may be very considerable, for which reason cold-cathode fluorescent lamps are attractive by virtue of their long life.

The opinion has often been expressed that the perfect lighting installation is one which is conceived as an integral part of a building as opposed to something that has obviously been added as an afterthought. Such a conception will probably involve lighting units built into the structure and, although fluorescent lamps will not necessarily always be the most suitable, their shape, dimensions, and low brightness are suited to the purpose. The best result can only be obtained if architect and lighting engineer work together while the building is still on the drawing board and the best use is made of the light sources available.

An outstanding example is the new House of Commons. In the Main Chamber the lighting is required to be inconspicuous, and general illumination is provided by 150 cold-cathode spirals mounted above panels in the roof and supplemented by hot-cathode fluorescent lamps under the galleries and behind carved woodwork. The lighting is dimmer controlled and can be gradually increased as daylight fades. The glass in the laylights has been so tinted that, with the lighting off, it matches exactly the surrounding oak beams and takes on the appearance of oak panelling.

Illuminated pillars and decorative features in the entrance hall of the Kursaal at Southend with blue and gold lamps in the amusement arcade opening out of the hall to provide a cheerful effect

Public Libraries

Advice on Positioning of Fittings

By HORACE WEST*

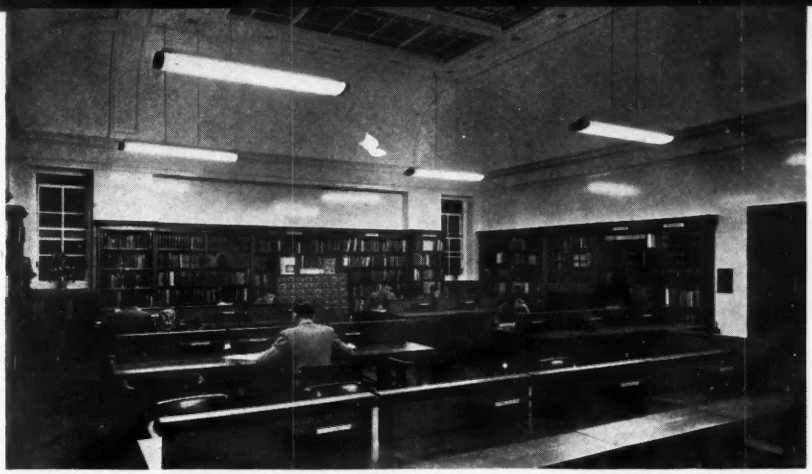
FLUORESCENT tubes are an excellent means of illuminating many public libraries. The book racks themselves, by reason of their construction, demand an extended light source. It is an architectural desirability that the lighting units chosen should blend with the general appearance, in addition to fulfilling their functional purpose. In new libraries only close collaboration of the architect with the lighting engineer and contractors will ensure that the lighting is an integral part of the design. The values recommended by the Illuminating Engineering Society's Code of Practice are: backs of books, 3 l/sq ft; book rooms, 7 l/sq ft; reading rooms, 7 l/sq ft; reading tables, 15 l/sq ft.

In the lending library sections book stacks are generally either straight or "fanwise," although in many modern libraries the racks are positioned round the walls. Where the stacks are in straight formation it is best to place the lighting units between each row, parallel to the major axis of the racks, thus maintaining a symmetrical system.

When shelves are situated around the walls a symmetrical layout can also be achieved and the use of twin-tube units will minimize the number of points thereby reducing the initial cost of the installation. Where the racks radiate "fanwise" outward from the issue counter they generally present a problem. The best solution in such cases will be to plan for general lighting, relating the units to the roof beams irrespective of actual book-stack positions. It may then be necessary to vary the positions slightly to ensure even and adequate light distribution over the bookshelves.

* *Thorn Electrical Industries, Ltd.*

The lending department of the Westminster City Library, Charing Cross Road, is an example of almost shadow-free lighting with an average of 12 l/sq ft on the vertical backs of the books while the book-shelves are light grey to reduce excessive contrasts



An attractive reference library illuminated by twin-tube 80 W decorative fluorescent fittings which have totally enclosed ribbed "Perspex" diffusing covers in keeping with the architectural features, providing 7 l/sq ft with 15 l/sq ft on the backs of the books

When reading tables are also in a book room with shelves around the walls it is essential that the illumination on the tables should be 15 l/sq ft with a minimum of 3 l/sq ft on the backs of the books on the shelves.

The level of illumination required in a reference library is 15 l/sq ft and it will generally be achieved by installing twin or triple tube fittings, conveniently spaced. In view of possible specular reflection from shiny art paper, or the reading tables themselves, it is desirable to use fittings with totally enclosed diffusing covers made of ribbed "Perspex" or, alternatively, reeded glass in some cases.

Most public libraries have a junior library where children may borrow books or read periodicals. This room is usually used for lectures in the evenings. Similar illumination values apply as those mentioned for the adult lending department, but care must be taken to ensure that the positions of the lighting units will not interfere with the line of projection or vision of the children looking at the lecture screen. Fittings placed at right angles to the screen will avoid the latter risk; they should be higher than the projector beam.

Issue desk lighting by twin 40 W fluorescent fittings behind obscured reeded glass diffuser covers recessed in the soffits, ensures an intensity of 3 l/sq ft on the ticket racks, while the cornice lighting in the entrance hall consists of 30 W fluorescent tubes concealed on either side

Lecture room lighting should preferably be by diffuser type fittings so as to ensure adequate distribution without glare. A very desirable asset to this section, for a slight increase in cost, would be a fluorescent dimmer system for total or partial darkness as required. Provision for from 10-12 l/sq ft can be made although if it is desired to use the lecture room as a reading room then the higher level of 15 l/sq ft should be adhered to.

The staff issue counter is a very important part of the library by reason of the prolonged visual tasks imposed on the eyes of the issue clerks when reading the index cards, which are normally in a finger-marked state. It is, therefore, essential to provide local or localized light, largely determined by existing needs in each individual building; normally this will mean one 80 W fitting immediately above and parallel to the counters, one on either side, placed above the benches on which the index cards are situated. A very interesting alternative is the use of fluorescent lamps recessed into the brickwork behind diffusing glass panels above the counter; or concealed by specially constructed cornices to indirectly illuminate the entrance hall. The scheme is rendered more pleasing by the introduction of vertical lines extending from the light source up to the ceiling. Enclosed fittings mouned directly on to the ceiling where the height is relatively low are also attractive.

Where a library has a glass skylight in the centre of the room to admit daylight, lamp fittings can be mounted behind the framework to allow the light to penetrate downward. Maintenance of such an installation must be allowed for, but this system will be very suitable where, for aesthetic reasons, it is undesirable to have a number of pendant fittings suspended from the ceiling.

Very pleasing effects can be achieved by using existing cornices around the walls to house fluorescent lamps inside specially constructed metal reflectors. For such indirect lighting it is essential that the fluorescent tubes overlap at the ends, to avoid dark patches. With highly ornate ceilings this arrangement will allow the architectural features to be shown to their best advantage, but it should be stressed that indirect systems will be expensive due to the large number of lamps and equipment needed to achieve the requisite illumination. It is alternatively possible to use the tops of the book racks to conceal the fluorescent equipment, which is best done where the area under consideration is fairly large, but should not be used in a confined space.

A recent development of our public library facilities is the gramophone lending library. If this room is small it may only require a simple arrangement whereby light is directed on to the vertical pigeon holes containing the records. For larger areas a general scheme of suspended, or ceiling mounted, fittings can be adopted. It is desirable that the actual issue counter shall be adequately illuminated so that the clerical staff may detect any damage to the records when returned by the borrower. In music lending libraries the general needs are very similar.

Where specially built-in cases are recessed into the walls for showing books of current interest, fluorescent tubes can be concealed behind frosted glass panels at the top and bottom to illuminate the interior of the cases.

Several borough councils have introduced a travelling library service. The fluorescent lighting of such vehicles has an economic aspect which has to be taken into consideration. Power is taken from 3-pin plugs connecting to feeder boxes mounted on the pavement. Only the librarian has access to these boxes. The fittings are 3 ft 30 W batten units with ribbed "Perspex" diffusing covers, which are essential due to the low mounting height. It will normally be found that shorter lamps will prove to be the most suitable.

Starter switches may be replaced by "Quickstart" units, the life of which components is equal to that of the whole installation. They are positive in action without any preliminary flickering, will function satisfactorily even when voltage fluctuates, and do not reduce the life of the tubes. The slight increase in cost can be justified if one takes into consideration the time spent by a maintenance engineer replacing starter switches.

The choice of lamp colour will depend to a certain degree upon individual taste, the decoration of the room and the daylight factor as well as upon the colour of the book racks themselves.

VIEWS on the NEWS

By REFLECTOR

THE first " tube " railway in the world was opened to the public on 18th December, 1890. It was the City and South London Railway constructed by James Henry Greathead between King William Street (near the Bank of England) under the Thames to Stockwell on the south side of the river. Each of the fourteen locomotives, built by Mather & Platt to the designs of Dr. Edward Hopkinson, was equipped with two 56 h.p. motors, the armatures of which were built directly on the axles, thus dispensing with gearing. Operation was on the three-rail system. The lighting of each car was by four 16 c.p. lamps. Rather superfluously, notices warned passengers (under a penalty of 40s) not to ride on the roof of the train.

* * *

There is a feeling in some quarters that the British Electricity Authority should seek to reduce demands on its system by some form of discrimination, mainly against domestic consumers. Already, of course, the Electricity Boards are guided by the " priority " rules drawn up by the late Electricity Commission some years ago and it is difficult to see what more they can do. It is certainly impossible to force the public to refrain from using the supply for, say, heating during certain hours ; reliance must still be placed on exhortation, ineffective though it may be. Perhaps the *Spectator* will amplify its suggestion that the B.E.A. should make " a careful scrutiny of the demands made upon it, not all of which are justifiable."

* * *

It is rather strange to find the *Observer* criticizing the B.E.A. for continuing " to behave as though it were a private concern bent on selling the maximum amount of electricity, whereas the national interest calls for less use of this extravagant method of turning coal into power." The writer acknowledges that power stations burn low-grade coal which other industries reject but (without giving particulars) contends that " it could quite well be treated and used in other ways." All this leads up to a call for a co-ordinated fuel plan. Surely co-ordination between the National Coal Board and the B.E.A. has gone a long way when the latter's consumption includes only 9 per cent of graded coals, against 28 per cent of cleaned smalls and as much as 63 per cent of uncleaned smalls.

* * *

It was Napoleon who said (I think) that every private had a marshal's baton in his knapsack. Likewise every power station manual worker in the British Electricity Authority's service has in his tool-bag the appropriate emblem (whatever it may be) of a Divisional Controller. In the North Western Division, I am told, several employees who have applied for consideration for appointment as junior engineers have been interviewed during the last few months and the results have been very encouraging. It was found that four of the applicants had attained the required standard ; one of them has been made a junior engineer already and the others will be considered as vacancies occur.

* * *

The custom of taking up a " penny collection " for the Electrical Industries Benevolent Association at gatherings of electrical men, instituted some years ago, is not so widely observed nowadays as it should be. Christmas seems to be the suitable time to call it to mind and to suggest that the practice need not be confined to formal or official functions. There are hundreds of parties arranged by, or including, electrical men and women at this time of year which provide excellent opportunities of passing round the hat for the E.I.B.A. A substantial total could be raised in this way.

* * *

One of the latest B.E.A. advertisements makes mention of the great number of consumers connected since " Vesting Day." I wonder what this means to the vast bulk of the public. Most of them probably think it has something to do with the abolition of clothes rationing.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons last week Sir Ian Fraser asked if, in view of the prospective shortage of electric power, the Government would revive the Severn Barrage project.

Mr. Noel-Baker said that a Severn Barrage could make no contribution to the supply of electricity during the next few years, since construction might take eight years. But the Government regarded the scheme as being of great interest, and arrangements were made some time ago to begin the preliminary work for the necessary model of the Severn Estuary.

Rural Supplies

In reply to a question by Mr. Baker, the Minister said his predecessor asked the Area Electricity Boards to give to supplies to farms and farm-workers' cottages, when the supplies would assist food production, a priority equal to that of new housing and essential public service requirements. There had been no change in this policy, but the rate at which the rural network could be extended was naturally controlled by the amount of capital investment which the nation could afford.

Sulphur Fumes from Oil

Mr. Keeling asked the Minister of Fuel and Power whether the experiments for eliminating sulphur oxides from the combustion products of oil fuel had been completed; and whether he could now give a guarantee that no sulphur fumes would be produced from the new power station opposite St. Paul's.

Mr. Noel-Baker said that the experiments were designed to find out which of the two practicable means of eliminating sulphur would be more suitable and effective. They had now been completed, and he was glad to say the method adopted would ensure that Bankside power station would not damage St. Paul's or other buildings in the neighbourhood.

Nickel Supplies

In reply to Sir Edward Boyle, the Minister of Supply (Mr. G. Strauss) said that nickel anodes normally took about 20 per cent of the nickel consumed in this country and the balance went into a wide variety of uses in the form of special steels and non-ferrous alloys. He was investigating with the firms concerned the position regarding the supply of anodes, but he was advised that the present supply was well above the level of 1949, though it was less than in the first half of 1950.

Plea for Fuel Economy

During a debate on the work of the National Coal Board, Mr. P. Noel-Baker, Minister of Fuel and Power, urged the most rigid economy in the use of coal by industrial and private consumers. He believed that industry could save 2 per cent of electric power without any loss of output, and this would save 100,000 tons of coal up to next April. If people at home and in offices could save 5 per cent of electricity, this would save 500,000 tons. National efficiency in the use of coal was most important and everyone engaged in industry and commerce should study the efficient use of the coal they consumed.

B.E.A. Advertising

On the motion for the adjournment on 12th December Mr. G. Nabarro raised the question of advertising by the British Electricity Authority. He said that the policy of advertising of the B.E.A. was completely out of harmony with the gravity of the fuel and power situation. There were power house advertisements which contained no exhortations to people to use less electricity. No information could be obtained regarding the cost of the advertising campaign or its purpose. It was incongruous that the B.E.A. should be encouraging people to use more electricity. Steps should be taken to set up an advertising policy for the coal, gas, and electricity industries.

Mr. A. Robens, Parliamentary Secretary, Ministry of Fuel and Power, said there was nothing wrong in putting up advertisements saying what was being done to provide electricity. He saw nothing to cause alarm in the B.E.A.'s posters. Some posters were used to urge people not to use electricity in the peak hours. The advertising had been changed according to the period of year, as was reasonable. Advertising was a matter of day-to-day administration of the B.E.A.

Generating Machinery Exports

Mr. Gammans asked the President of the Board of Trade what was the value since the end of the war of exports of electrical generating machinery and equipment suitable for new generating stations or extensions; and what was the value of such equipment sent to countries beyond the " Iron Curtain."

Mr. Rhodes, who replied, said that equipment intended for use in generating stations was not separately distinguished in the trade accounts but the value of electrical generating equipment of a type used in power stations produced between January, 1946, and September, 1950, for export amounted to £32 million. Less than £2½ million of this total went to countries beyond the " Iron Curtain."

Architectural Ensemble

The Trend Towards In-Built Lighting Systems

By W. T. SOUTER, F.I.E.S.*

THE term "in-built" lighting, as the name suggests, refers to systems in which the fittings are an integral part of the fabric of the interior of the building and, as such, represent a complete break from the conventional forms of pendant equipment. This obviously necessitates close co-operation of the architect with the lighting engineer at the drawing board stage of building projects. There have been many notable instances in which installations of merit have clearly indicated the advantages to be gained by this welcome liaison, which is now both recognized and practised.

Natural lighting devices have always been built into the structure of the building in the form of windows, dormers and laylights, constructed as integral parts of the walls and ceilings and designed as corporate parts of the architectural ensemble. In the early days of electric lighting attempts were made, with varying degrees of success, to emulate such conditions by the installation of reflectors over the glazing of natural or artificial laylights, but because of the low efficiency obtained and the somewhat gloomy aspect

* Holophane, Ltd.

Example of the use of semi-recessed fittings which project slightly below the ceiling of the theatre/restaurant in a cigarette factory

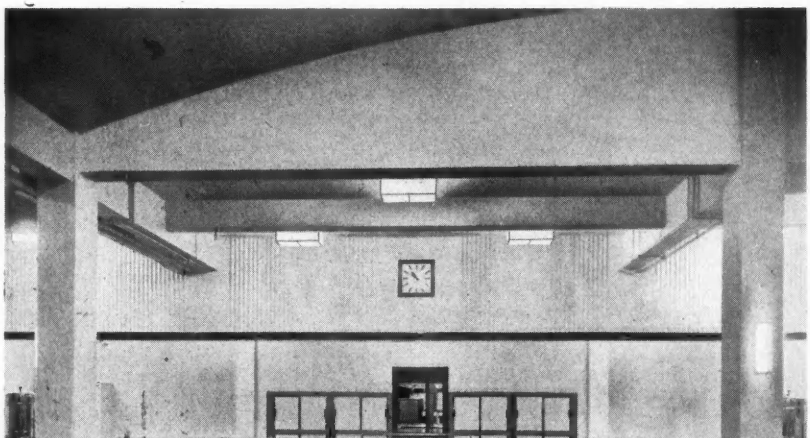
of the upper regions of the interior, such methods were regarded as being unsatisfactory unless supplementary illumination was employed.

The light output efficiencies of lamps at that time and other economic considerations naturally favoured the continuance of the traditional form of pendant lighting which had become established over the centuries in the application of the earlier forms of illuminants, the low brightness of which caused relatively little discomfort to the eye. This convention has persisted despite the fact that the original fundamental reasons for the employment of pendants no longer exist.

The light output efficiency and intrinsic brightness of the modern electric lamp are such that the illuminating engineer's most acute problem is concerned with the avoidance of discomfort glare. To alleviate that condition the pendant lamp is often enclosed in a diffusing translucent fitting having a low transmission factor in order to give reasonable proportions, but this must be regarded as inefficient as it negatives the potential efficiency of the lamp. Alternatively, the lamp is housed in a very large diffusing enclosure having a higher light output efficiency, under which conditions the fitting is immediately obtrusive and out of harmony with the surroundings. Furthermore, the total amount of light reaching the eye from the latter type of fitting may still be uncomfortable, despite the fact that the surface brightness may normally be considered to be acceptable.

A further and apparently obvious remedy is to increase the mounting height of the fittings in the knowledge that the greater angle of separation above the normal line of vision is the most effective means of reducing glare conditions. While, however, it is practicable to adjust the light distribution characteristics of the units to maintain an efficient utilization and uniformity of illumination at the increased mounting height, it may often be undesirable to reduce the suspension length of the fitting for aesthetic reasons. The mounting height of a pendant unit and its length of suspension must be in harmony with the proportions of the building interior, or the particular

Effective combination of in-built lighting and ventilating schemes in a works canteen



Wall-map feature of American Overseas Airlines showroom with local illumination of ticket counter

architectural elements to which it is related ; for this reason alone, the actual mounting height is frequently determined by reasons other than the fundamental requirements of lighting design.

These requirements become even more complicated when considering the preservation of sight lines from the most elevated seats in the balcony or gallery of a public building, so a pendant system in such circumstances usually results in a compromise, which is often open to criticism from several aspects.

It is a logical development, therefore, to eliminate the suspension element and to design the lighting equipment as an integral part of the ceiling structure, whereby aesthetic considerations and unobstructed side aisles are preserved, while the increased angle of visual separation is such that glare is eliminated.

At first sight it might be thought that a system of in-built fixtures would present difficulties with regard to access for maintenance purposes, but in practice it is found that such systems can be classified into two categories in which this necessary requirement can be satisfactorily accomplished. In one category, the ceiling height of the rooms is of the order of 10 to 15ft and can be conveniently reached from below by the use of trestles. The second classification includes halls and similar interiors where the ceiling height may vary between 20 and 40ft, in which it is quite usual to find a void above the ceiling which allows convenient access from above for servicing purposes.

It is a fair statement, therefore, that there is a very good case to be made in favour of in-built lighting, which few will deny, but it is the problem of efficient light utilization under such conditions which has retarded the more general application of this system. The satisfactory employment of the method can only be achieved when the equipment is designed with knowledge of all the essential requirements, and an efficient and flexible method of accurate light control is fundamental to its development. The light distribution characteristics of the fittings must provide a satisfactory standard of utilization and uniformity on the working plane under

different mounting heights and spacings, which need automatically suggests the desirability of alternative and interchangeable optical assemblies within the lighting fixtures.

Apart from the functional aspect of providing adequate and suitable illumination for the particular activity for which the building interior is intended, it is also important to ensure that all the surfaces of the room, including walls and ceiling, present a pleasing pattern of visual brightness which is in harmony with both the architectural style and the atmosphere of the building. That intangible impression described as the "atmosphere" of a room or building interior can be materially influenced by artificial lighting in the creation of a pleasing or unattractive environment, and those psychological reactions which can be attributed to visual impressions.

While these conditions can often be fulfilled in a pleasing and satisfactory manner by the employment of flush in-built fittings, with supplementary concealed light for the ceiling from cornice or flambeau equipment, the scope for schemes of this nature is somewhat limited under present conditions in which capital costs and running charges are serious considerations. The general application of the system, therefore, necessitates the design of equipment which will provide a suitable horizontal lighting component for adequate illumination of the ceiling area.

This can conveniently be achieved by the provision of semi-recessed fittings projecting slightly below the ceiling line and incorporating translucent side glazing panels. Apart from considerations of uniform flashing, the side and lower glazing panels must fulfil the important function of transmitting the light from the lamp and reflector without serious loss and without material change in the distribution characteristics. In this connection, prismatic panels designed to afford the properties of a lens offer distinct advantages in the accurate control of both the reflected and bare lamp components. Panels of this type, providing alternate types of light distribution, can be conveniently built up into a range of multi-lamp fittings of different sizes sharing a basic design to meet the varying requirements encountered in most classes of buildings while maintaining the homogeneous appearance of the complete installation.

This system lends itself conveniently to the development of fittings accommodating either general lighting service lamps, or tubular fluorescent discharge lamps in multiple combinations of various sizes and wattages which are available for this service.

The large physical dimensions of the fluorescent tubular lamps and the ancillary gear naturally encourage ceiling mounting. Where recesses are available, an in-built system offers obvious advantages for the concealment of the bulky metalwork housing the operating equipment and thereby allows more freedom in the aesthetic development of the visible part of the fitting.

Apart from the more general application of this system in all classes of public buildings, it offers particular advantages for the provision of accurately controlled light distribution when the avoidance of specular images is essential, such as in art galleries, power station control rooms and other similar installations.

The theatre/restaurant of the new W. D. & H. O. Wills cigarette factory at Newcastle is a good example of the use of semi-recessed fittings which project slightly below the ceiling. Looking towards the serving counters at the rear it will be seen that adequate ceiling illumination is provided by the two rows of fittings, one on each side of the centre laylight; supplementary light over the laylight prevents this feature having the appearance of a void at night.

The application of multiple in-built fittings has many advantages and enables the lighting system to be planned in conjunction with other services. The new canteen at the Caley Works of John Mackintosh & Son, Norwich, illustrates the effective combination of lighting and ventilation schemes, resulting in an attractive ceiling layout without any appearance of the ceiling being crowded. It will be noticed that, as in the case of the W. D. & H. O. Wills installation, the use of semi-recessed fittings provides the right degree of ceiling illumination to keep the brightness values of the surroundings in the correct proportion.

Flush ceiling fittings can often be employed with advantage to provide a high local illumination without detracting from a display in the background. The new ticket office of American Overseas Airlines in London is a case in point, the showroom feature being a map on the wall, while flush ceiling fittings provide the required local illumination for the counter.

These photographs indicate the possibilities of in-built fittings, and of the scope for planned systems as integral parts of buildings.

PERSONAL and SOCIAL

News of Men and Women of the Industry

IN our last issue the appointment of **Mr. L. W. Stretton,** M.I.E.E., as chief generation engineer (operation) of the Eastern Division of the British Electricity Authority was briefly announced. Mr. Stretton has been generation engineer (operation) of the Division's southern group of power stations since vesting day. He takes over his new responsibilities on 1st January. Mr. Stretton was born at Penn, Bucks. He was educated at the Royal Grammar School, High Wycombe, and Bedford Technical Institute and received his practical electrical training in the Bedford Electricity Department. He became deputy station superintendent of the Taylor's Lane (Willesden) power station of the Northmet Power Co. in 1933 and station superintendent in 1941. Five years afterwards he was appointed station superintendent of the Brimsdown "A" and "B" stations.

Mr. F. W. Pridmore has relinquished his position as works manager of the Igranic Electric Co., Ltd., Bedford, upon his appointment as managing director of Brookhirst-Igranic S.A. (Pty.), Ltd., of South Africa. Mr. Pridmore served his apprenticeship with the Igranic Electric Co., and has been with the company for twenty-two years. In 1940 he was attached to the Leeds branch as machine tool specialist engineer and in 1943 returned to the Bedford works as machine tool liaison officer. Later in the same year he was appointed personal assistant to the works manager and he became works manager in 1945.

Mr. F. W. Pridmore

At a meeting of the London Station Engineers Branch No. 1 of the Electrical Trades Union on 15th December an inscribed gold wristlet watch was presented to **Mr. H. H. Morton** in recognition of his 35 years' service to the E.T.U. in particular and the trade union movement in general. A presentation is also to be made to his wife.

Mr. H. Kingsbury, M.I.E.E., European plant engineer of the Western Union Telegraph Co., is retiring at the end of this month, after being associated with the company for over thirty years. He will be succeeded as European plant engineer by **Mr. R. A. Goodman,** B.Sc.(Eng.), M.I.E.E.

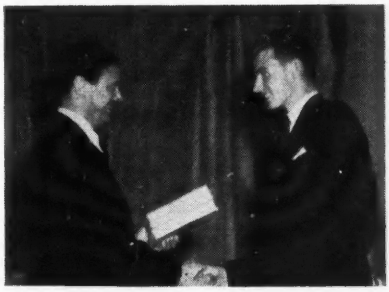
Councillor W. B. Adams, M.I.E.E., of Hassocks, Sussex, has been appointed a member of the South Eastern Electricity Consultative Council.

The fifth annual dinner and dance of the Tunbridge Wells and Maidstone branches of the **Electrical Contractors' Association** was held at the Royal Star Hotel, Maidstone on 7th December, about 300 attending. Mr. F. A. Strange, M.C. (chairman, Tunbridge Wells branch) occupied the chair and among those present were the Mayors of Tunbridge Wells and Maidstone, Mr. P. G. Wallis (president, E.C.A.), Mr. L. C. Penwill (director, E.C.A.) and representatives of the South Eastern Electricity Board. The speakers included Alderman C. G. Larking, Councillor Miss Muriel Wells, Mr. H. F. Knell, Mr. P. G. Wallis, Mr. S. B. Fletcher and Mr. C. Cameron-Kirby.

A recent function at the Prescot Works of **British Insulated Callender's Cables, Ltd.,** was the annual prize-giving ceremony in recognition of students' successes in the works day continuation school and at local technical colleges. Mr. N. G. Treloar, the company's education officer, gave an encouraging report on the year's progress. Two notably successful students were able to be present—Mr. B. J. Wardley, who had been awarded the Duddell Scholarship by the I.E.E., and Mr. J. C. Clegg, who had won a technical State scholarship; both are now at Liverpool University.

Dr. L. G. Brazier, director of research and

Dr. L. G. Brazier presenting an award to Mr. J. C. Clegg



engineering, presented awards to some 150 students. He said that the education scheme provided opportunities for the most junior apprentice to rise to a high position in the management.

Presentation ceremonies have also been held at the Helsby, Erith and Anchor Works.

Mr. F. C. McLean, M.B.E., B.Sc., M.I.E.E., has been appointed head of the newly formed Engineering Projects Group of the B.B.C., composed of the Planning and Installation Department and the Designs Department. **Mr. F. L. E. Pawley,** M.Sc., M.I.E.E., succeeds Mr. McLean as head of the Engineering Services Group. **Mr. A. N. Thomas,** A.M.I.E.E., succeeds **Mr. T. C. Macnamara,** A.M.I.E.E., who has resigned from the B.B.C., as head of the Planning and Installation Department.

Mr. R. C. Milner, A.R.I.C., and **Mr. C. T. W. Sutton,** M.Sc.Eng., M.I.E.E., A.M.Inst.C.E., A.M.I.Mech.E., are now associate directors of Enfield Cables, Ltd. Mr. Milner joined the company as chief chemist in 1937. Mr. Sutton, who has been with the company since 1926, has specialized in the development of h.v. transmission by underground cables and in the Enfield compression cable system.

Mr. H. E. Humphries, M.B.E., manager of the Telecommunications Department of Siemens Bros. & Co., Ltd., has been appointed a director.

On 2nd December the Manchester branch of the **Reliance Telephone Co., Ltd.,** held its first annual dinner and dance. Eighty-four people attended, including Mr. E. Silbermann, managing director. The chair was taken by Mr. A. Bailey, Manchester branch manager, and an excellent meal was provided at the Bodega Restaurant, Manchester. Dancing, and entertainment by Messrs. Bryn Jones and Harold Shea, followed.

Two celebration dinners took place recently at the works canteen of **Bulpitt & Sons, Ltd.,** Birmingham. The first of these was on 17th November when employees with twenty-five years' service or more were presented with gold wrist-watches. Altogether seventy-six employees, with their wives and husbands, and a number of pensioners and associates of the firm, sat down to dinner. The watches were presented by the three senior directors, each of whom has a record of long service—Mr. W. H. Bulpitt, with fifty-seven years' service, Mr. A. E. N. Bulpitt (fifty-five years) and Mr. W. S. Bulpitt (forty-seven years). The second event was a dinner and concert given by the company on 27th November in honour of the seventieth birthday of Mr. A. E. N. Bulpitt. The function was attended by staff of over ten years' service and employees of over fifteen years' service. Mr. Albert Bulpitt's health was proposed by Mr. F. W. Bulpitt and seconded by Mr. T. Bradford, senior foreman, and he was presented with an inscribed silver rose bowl by Mr. F. T. Murphy, on behalf of employees and staff.

Senior directors of Bulpitt & Sons, Ltd. (left to right): Mr. W. S. Bulpitt, Mr. W. H. Bulpitt and Mr. A. E. N. Bulpitt

WILLS

Mr. F. Hope-Jones, M.I.E.E., F.R.A.S., F.B.H.I., the well known horologist, and managing director of the Synchronome Co., Ltd., who died on 3rd April, left £3,836 gross (£3,394 net).

Mr. D. S. Munro, M.I.E.E., a pioneer in electrical engineering in Scotland, who died on 8th July last, left personal estate in England and Scotland valued at £20,784.

Mr. C. H. Champion, A.M.I.E.E., M.I.Mech.E., chairman and managing director of Charles H. Champion & Co., Ltd., and managing director of the Ship Carbon Co. of Great Britain, Ltd., who died on 30th August last, left £88,516 gross (£83,855 net).

Australian News

From a Correspondent

THE Victorian Minister for Electrical Undertakings (Mr. Dogshun) says that the State Electricity Commission proposes to extend its area of supply along the entire Murray Valley to the border of South Australia. The plan provides for the construction of a 220 kV transmission line from Kiewa to Mildura, together with the erection of diesel-operated regional power stations at Mildura, Swan Hill and Shepparton. Expenditure is likely to be in the vicinity of £6½ million, to be spread over the next 15 years. Each of the power stations is expected to cost £1 million.

The Clarence River County Council (New South Wales) recently placed an order for a 7,500 kW Metropolitan-Vickers turbo-alternator for a new power station to be constructed at Koolkhan.

Gymnasium Lighting

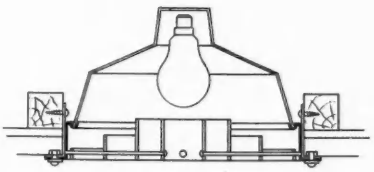
Practical Advice on School Installations

By H. PUNTER*

HOW to light the gymnasium in the newly erected schools with varying roof structures has been quite a problem for architects. It is natural, when so much care is being taken with the design and construction of educational premises, to require the fittings to be aesthetically correct.

The average gymnasium of reinforced concrete construction lends itself to a false ceiling into which a laylight type of recessed lighting fitting can easily be fixed with suitable battens. Provided a suitable back box with white enamelled finish is used, a gymnasium 60ft by 40ft should have twelve fittings housing 300 W lamps to furnish 8 lumens/sq ft.

To proceed in this way and to place the lamp a suitable distance from the glass, a recess of 16in is necessary. It is not desirable to have the lamp nearer than 3in to the under glass. In cases in which lamps of less than 300 W will suffice for the requirements, Georgian wired glass can be used safely, but above this wattage heat resisting toughened glass is strongly recommended. Where 16in back room is not available, it may be necessary to use a semi-recessed fitting which is effectively a box fitting.



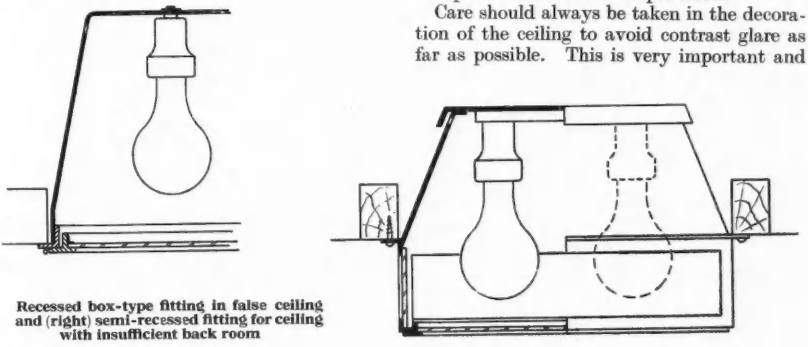
Louvred roof fitting for school gymnasium

Maintenance is always a problem in gymnasiums, the average height being approximately 16ft. If sufficient ceiling room is available, maintenance can be carried out from above. More frequently the space in the roof void is inadequate for this convenient method, so the fitting has to be hinged from beneath, which means the use of very long ladders or a tower wagon.

Premises used for gymnastics and general exercises have in the past been illuminated by industrial reflectors. Even to-day reflectors with wire guards are effective, but do not satisfy the full needs. Direct glare is to be avoided and can be by fixing suitably designed louvres. In this way a reasonably cheap installation can be provided.

Care should always be taken in the decoration of the ceiling to avoid contrast glare as far as possible. This is very important and

* Manager, Technical Department, Falk, Stadelmann & Co., Ltd.



Recessed box-type fitting in false ceiling and (right) semi-recessed fitting for ceiling with insufficient back room

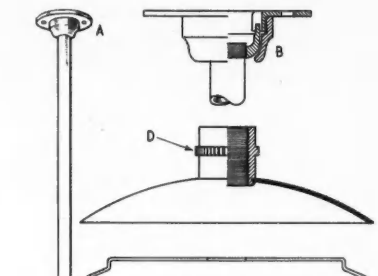
is an argument in favour of semi-recessed fittings, which place the light source below the ceiling level. It is, nevertheless, preferable to avoid ceiling projection, to pay the necessary careful attention to decoration and to fit laylight type fittings, avoiding obstructions for ball games. If badminton is played in the hall, extra side lighting may be desirable and can be provided by the use of angle parabolic reflectors of the usual commercial type, or, preferably, fluorescent lamps in specially designed reflectors, this method being entirely dependent upon the width of the hall.

It may appear that undue stress is being laid upon gymnasium lighting, but it must be remembered that this portion of a school is quite frequently used more during the dark hours than any other part of the building. Old pupils' associations and parent-teachers' clubs are now being formed and it is not uncommon for these organizations to find the gymnasium the most popular rendezvous.

Certain other practical details which often seem to be overlooked can give architects and electricians much trouble, especially when they are dealing with prefabricated buildings or hutments used as semi-permanent premises. To cut costs, in these cases, false ceilings are discarded and roofs are left unscreened. In consequence, lighting fittings are fixed to conduit boxes at an angle of the order of 20 deg to the horizontal.

The obvious method in a case of this type is to use a chain-suspension fitting, but there is, unfortunately, one serious drawback in practice. In schools and commercial premises where opal globes are most favoured for tungsten lamps it is occasionally found that the unit globe is not perfectly balanced and with chain-suspension the out-of-balance becomes pronounced. The only satisfactory method of suspension is by rod. The average commercial rod-suspension fitting is fitted with a ball joint to allow a 15 deg swing either side of the vertical. This is obviously totally inadequate in the present case, for which metalwork of special design is necessary. (See drawing.)

A two-piece ceiling plate (A) incorporating a ball socket permitting a 30 deg swing from the vertical will allow sufficient angle to enable a conduit box to be mounted on a 20 deg canting roof. In this way, the weight of the globe and down rod pulls the down rod vertically and, as the carrier is rigidly fixed to the rod, any unevenness in



Rod suspension for canting roof fitting designed to ease maintenance

glassware weight is immaterial. The centre line of the fitting is definitely vertical.

Further practical details to be considered are that the fittings should have ⅜in down rods, which, apart from aesthetic considerations, have the advantage from the contractors' point of view that v.i.r. cables can be pulled through to the lampholder (E.s.) without connections at the conduit box. To facilitate this operation a two-piece ceiling plate is necessary. The upper portion of the plate (B) is fixed to the conduit box through which the v.i.r. cable is pulled and the down rod is easily turned into position on the already fixed upper plate. The rod should be arranged so that the ceiling plate can be screwed into position without turning the down rod, which can be effected by a 360 deg stop on the ball and socket.

A threaded collar (C) fixed, say, 4in from the monkscap (D) at the lower end of the down rod facilitates maintenance. To replace a lamp or unit globe the monkscap (D) is released by an anti-clockwise twist and then raised to the collar (C) where, by one clockwise turn, the monkscap is fixed while the globe is removed and the lamp replaced. This device overcomes the inevitable gymnastics necessary to hold the usual cap in one hand and balance the globe in the other.

ELECTRICITY SUPPLY

November Generating Statistics

Power Position in Scotland

THERE was an increase of 55,000 kW in the total generation capacity in the British Electricity Authority's area in November and 65,000 kW was added in the North of Scotland. This made the aggregate for both areas 14,775 MW, compared with 13,605 MW a year ago. In the past twelve months, therefore, 1,170 MW has been added to the overall installed capacity.

During November the quantity of electricity generated attained the record figure of 5.370 million kWh, an increase of 8·6 per cent over the corresponding month of last year. The total included 140 million kWh from water power, whereas in November, 1949, only 121 million kWh was thus generated. Further details of output, fuel consumption, etc., are given in the accompanying table.

Up to 3rd December this year (49 weeks) energy sent out for public supply amounted to 46,430 million kWh, against 41,811 million kWh in the corresponding period of 1949.

Tenants to Choose

The tenants of new houses erected by Chichester City Council are to be given the opportunity of choosing either electric or gas cookers, but in the case of electric cookers they will have to pay for maintenance.

Malvern Hills Scheme

Alderman W. S. Lewis, chairman of the Midlands Electricity Board, stated recently that the Board had now reverted to the original idea of using wooden poles instead of towers for the proposed line over the Malvern Hills. The cost would be about £8,000. He added that there was only one pole that people would notice. The Board was waiting for the Minister to decide the date of another inquiry. Mr. G. F. Peirson, chief engineer, said that the Board wished to make use of existing 66 kV lines as far as possible.

Scottish Power Cuts

Recent power cuts in Scotland were discussed on 7th December by the corporations of Glasgow and Edinburgh. Glasgow agreed to appoint a special committee to assist the electricity authorities in dealing with the situation, while Edinburgh decided to approach the Secretary of State for Scotland, calling for the establishment of a single electricity board in Scotland responsible for both generation and distribution. The Lord Provost of Edinburgh, Sir Andrew Murray, after consultation with the Lord Provost of Glasgow, is to meet Lord Citrine, chairman of B.E.A., and discuss the situation with him.

Hired Electric Irons

The Merseyside and North Wales Electricity Board is giving those consumers who have electric irons on hire agreements the opportunity to purchase the irons at 3s each.

Shoreham Harbour

At a meeting of the Shoreham Harbour Trustees recently the General Purposes Committee reported that the British Electricity

Electricity Generated, Fuel Consumed and Plant Capacity

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	By Steam	Water power	Total*		
British Electricity Authority	3,080	7·0	5,180	47	5,245	4,958	14,268
North of Scotland	20	1·3	26	93	125	124	507
Total for November, 1950	3,100	8·3	5,206	140	5,370	5,082	14,775
Total for November, 1949	2,795	6·1	4,670	121	4,811	4,547	13,605
Increase, per cent	10·9	36·1	11·5	15·7	11·6	11·8	8·6
Total for year to date (11 months)	28,339	62·1	47,576	1,331	49,112	46,367	—
Total for first 11 months of 1949	25,997	46·9	42,872	1,024	44,075	41,558	—
Increase, per cent	9·0	32·4	11·0	30·0	11·4	11·6	—

* The total figure includes generation by oil engines and waste heat plants amounting to 13·1 million kWh and 10·3 million kWh respectively in November.

Authority had not yet advised Trustees whether it intended to proceed with the harbour development scheme. It was resolved that the suspension of the financial provisions of the Shoreham Harbour Act, 1949, should be continued and that the matter should be reconsidered at the next meeting of the Committee.

Rumanian Ten-Year Plan

According to the Vienna correspondent of the *Manchester Guardian*, a ten-year electrification plan for Rumania has been introduced to the Communist Central Committee by the Deputy Premier, Mr. Gheorghiu-Dej. It aims to increase the country's generating plant capacity from 600,000 kW to 1,660,000 kW in the first five years. Twenty-four hydro-electric plants are to be built aggregating 764,000 kW.

Exhibits at Agricultural Shows

Referring to the Board's exhibits at agricultural shows the "Eastern Electricity Bulletin" says that although the cost of these exhibits is considerable, the amount of business resulting from them is also large. Figures are given showing that the total so far is £20,800, but it is pointed out that such sales are slow to mature and it is expected that the total will eventually be twice the present amount.

Marchwiel Power Station

The small power station at Marchwiel, near Wrexham, formerly operated by Wales & Monmouth Industrial Estates, Ltd., has been taken over by the Merseyside and North Wales Division of B.E.A.

New Street Lighting Method

The East Sussex & South West Kent Sub-Area of the South Eastern Electricity Board, with the approval of the Eastbourne Corporation, has recently put into commission an original form of street lighting in South Street, Eastbourne. Lanterns with single 5ft fluorescent lamps have been fixed to the face of the buildings along the street with the light source parallel to the street, thus obviating the use of columns, wall brackets or span wires. The effect is most pleasing; by night the street is most evenly lighted and visibility is excellent, whilst by day the lanterns are scarcely visible.

Self-Balancing Recorder

A SELF-BALANCING recorder developed by the Metropolitan-Vickers Electrical Co., Ltd., employs the latest technique of null balance measurement, being a continuously self-balancing instrument using electronic power amplification and a motor drive. This principle not only gives a true continuous record of a rapidly changing variable, but eliminates the sensitive galvanometer and complicated feeler mechanism associated with earlier instruments. Extreme reliability is thereby obtained, and the design lends itself to the robust construction of apparatus required for use under arduous industrial conditions. Ample power is available at the main shaft to operate alarm contacts or an automatic controller, and the high speed and sensitivity make it an ideal instrument for automatic control work where lags and "dead time" must be minimized.

For recording temperature from a thermocouple the instrument is arranged as a d.c. potentiometer. A fixed voltage is maintained across a slidewire by means of a rheostat and an air-depolarized dry battery. Every fifteen minutes this voltage is balanced automatically against a standard cell and readjusted if necessary by means of a motor driven rheostat. The output from the thermocouple is compared with the voltage across the slidewire, and the difference voltage is amplified and used to drive the potentiometer to balance, at the same time driving the pointer and recording pen. To facilitate the use of a stable a.c. amplifier, the unidirectional difference voltage is converted to 50 c/s a.c. before amplification by a vibrator convertor of proven stability.

The instrument is extremely rapid in operation, traversing the 10in scale in 2 sec with no overshoot; there is also a special model in which the pen traverses the scale in 1 sec with less than 0·03in overshoot. An accuracy of $\pm 0{\cdot}25$ per cent of full scale is claimed for all ranges above 1 μV. This is unaffected by reasonable changes in supply voltage and frequency or ambient temperature, but when used in conjunction with a thermocouple, automatic compensation for cold junction temperature changes is provided. The d.c. potentiometer can be used for recording any variable that can be converted into a unidirectional voltage. The high sensitivity of the instrument enables it to respond to input signals of less than 1μV, the minimum full scale range being 500 μV. The maximum permissible input-circuit impedance is about 1,000 Ω for a range of 1 μV, but this can be increased on higher ranges.

The instrument records on a strip chart 10in wide; a circular-chart model is being developed. The roll chart is 120ft long and is driven by a synchronous motor through a six-speed gear box; a chart speed of 1, 2 or 3 in/hr or in/min can be selected by means of change levers. The instrument is housed in a robust sheet-steel dust-proof case arranged for semi-flush mounting, and occupies a panel space of 20in by 17in.

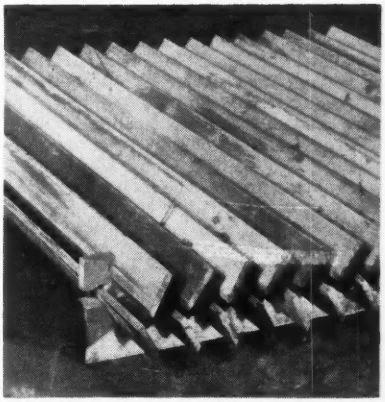
Better Cooling Towers

Eliminators Prevent Precipitation

FOR many years past the public has been inconvenienced by the "artificial drizzle" which can occur, under certain atmospheric conditions, in the vicinity of the cooling towers at some power stations. Abatement of this "misty rain" has been delayed by the mistaken idea that it was due to condensation of water vapour emerging through the throat of the tower.

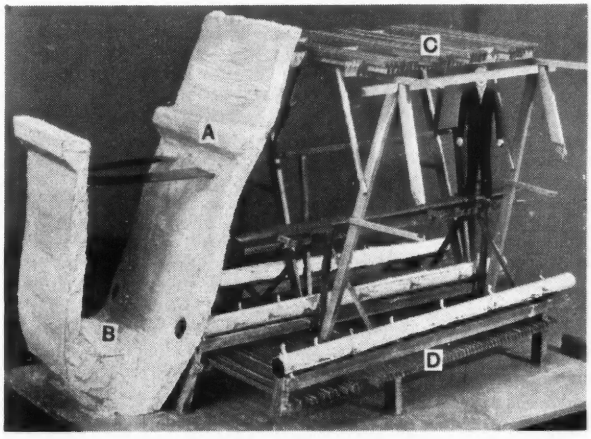
Investigation has been organized by the British Electricity Authority's research establishment (Dr. J. S. Forrest) from Croydon, where experimental data from towers at various power stations were co-ordinated and a model tower was erected at the old Croydon "A" station for further tests under controlled conditions and the development of methods and instruments for measuring precipitation more accurately.

Confirmation has thus been obtained of the view that the nuisance is caused by small droplets of water which are picked up by the upward flow of cooling air and carried by it out of the top of the tower, the entrained particles settling to the ground sometimes several hundred yards away downwind. The falling droplets can be seen if viewed against a dark background in a good light, but should not be confused with the white plume of "steam" from the top of the tower, which is innocuous.



Section of wooden "eliminator" showing louvres

The essential practical problem is to prevent droplets escaping from the tower. Other aspects, which are less generally appreciated, are that—practically all the drizzle must be prevented; a scheme which merely reduced the extent of the nuisance would be unlikely to justify the expense of installation. The operation of a water cooling tower depends on the water giving up its heat to the air passing through it, so the airflow must not be restricted more than absolutely necessary. Imperial Chemical Industries, Ltd.,



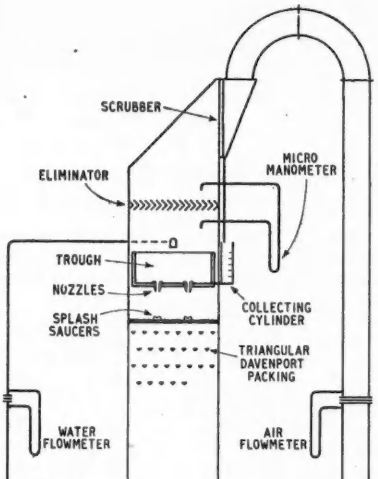
Model of section of tower shell (A) with annular conduit (B) indicating (C) position of louvre "eliminator" relative to top of existing packing (D)

developed a practical method of substantial reduction of the amount of water carried out of an induced draught cooling tower. That experience was made available to the B.E.A., whose towers are of the natural draught type, but it decided upon a design for the modification of a tower at Darlington. This tower was put back into operation in November, 1949, and the experiment was a complete success. Arrangements were made for similar alterations to the two other towers at that station ; the work is now complete and a great deal of useful information has been gained. The modification, however, was somewhat complicated and expensive and involved minor practical disadvantages.

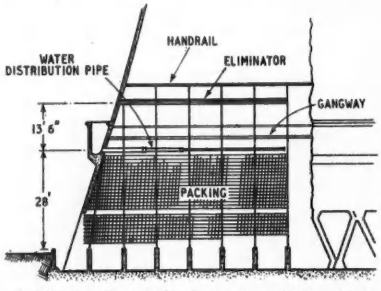
Meanwhile several promising alternatives had been devised, but it was apparent that further research was desirable. The special apparatus constructed at Croydon to overcome difficulties in measurement when testing full sized towers was completed in April of this year and in the following four months over fifty different schemes were tested under strictly comparable conditions.

Fan-induced draught is employed for experimental convenience and the air is recirculated in a closed circuit to keep it saturated in order to avoid errors due to condensation and evaporation. The amount of water eliminated, or carried out of the tower, is very much dependent upon the rates of circulation of both water and air within the tower.

From the results of these tests, for which Mr. H. Chilton was responsible, a simple arrangement was devised which removes practically all of the water droplets, while presenting little obstruction to the airstream. Special care was taken to reduce the amount of timber required to the minimum compatible with a satisfactory working life in the exacting conditions in a cooling tower. A "louvre type eliminator" is fitted horizontally across the tower some 10ft above the level at which the water is introduced. It traps the water droplets very soon after they have been picked up.



Combined internal and external representation of experimental "tower," indicating closed-in circuit and instrument positions, not to scale diagrammatically



Position in which "eliminator" would be added to existing cooling tower

The cost of this modification is under one quarter of that for the scheme installed at Darlington, and it allows even less water to escape from the tower.

A programme for modifying all B.E.A. towers which have been the cause of complaint will be put into effect in 1951. All new towers in built-up areas will be fitted with eliminators during construction.

Further research is to be conducted with a view to reducing the size and cost of cooling towers and also to finding more durable materials for use inside the towers (for instance, woven glass) in place of the usual wood packing.

Lighting for Fabrics

Need for Colour Discrimination in Home Furnishing

By HARRY HEWITT, A.M.I.E.E.*

THE textile industries make a colourful contribution to the domestic scene. They provide the curtains for our windows, the carpets for our floors, the whole range of soft furnishings and the clothes we wear. The effectiveness of these materials when seen under artificial lighting is determined, to some extent, by the skill and discrimination with which light is chosen and applied; for by the correct selection of lamps and fittings the appearance of fabrics can be enhanced in form, in texture, and, most of all, in colour.

The apparent colour of an object depends upon the nature of the object, the kind of light falling upon it and the eyesight of the observer. The first two of these factors are normally within our control and their interaction can either be used deliberately to provide effective and even beautiful results, or it can be misused, with inevitable disharmony. Nowhere is this more apparent than in the lighting of fabrics, for the art of the designer and the science of the dyer depend for success on the light in which their work is seen. As long ago as 1786 a Manchester dyer wrote :—

> "Notwithstanding the astonishing Rapidity in Rays of Light, they alight on the tender Retina of the Eye with so much softness as not to hurt it, nor injure the finest Flower whilst it is growing. They fall on the whole compass of our Atmosphere and when they fall on the Earth, whatever Bodies they alight on a Part is absorbed and the rest are reflected, and are the Cause of all Colours."

The nature of the fabric has long been under the control of the dyer, who makes a deliberate choice to achieve an effect which, until recent years, could be forecast with reasonable accuracy; for textile products were usually seen either in daylight or under forms of incandescent light which predominated, to various degrees, in the red/yellow part of the spectrum. This "warmer" indoor lighting became accepted by usage and problems of colour rendering arose chiefly at the moment of purchase, when customers usually preferred to make their choice in daylight as the unofficially accepted standard.

During the last decade, however, the development of light sources, particularly of fluorescent tubular lamps, has enabled wide and accurate control of colour. While this facility has been a boon to the lighting engineer, it has made problems of colour rendering more complicated and the general public has become more critical. In the future, therefore, the textile manufacturer must take account of the facts that his products are likely to be seen not only in daylight, but also under artificial lighting of various spectral qualities; and that they will be seen by a public rapidly becoming more colour-conscious and likely to become more appreciative of colour harmony.

Warm Light Preferred

The illumination intensities normally provided indoors are very low compared with daylight and it has been found in recent years that, at these relatively low intensities, people still prefer "warmer" illuminants, even though artificial daylight has become available (it is noticeable that a room lighted by "daylight" fluorescent lamps to an unduly low intensity looks even more cheerless than if a similar intensity had been provided by tungsten filament lamps). This preference for red/yellow lighting, especially in social surroundings such as the home, restaurants, clubs, etc., has led to the introduction of alternative fluorescent lamps, such as the "warm white," "peach" and "mellow."

While these newer lamps provide a cheerful and cosy atmosphere, their effect on colours is not so immediately acceptable. A distinction must be made between the colour appearance of a lamp and the colour rendering of objects seen under its light. Two sources of light may appear similar to the eye and yet, owing to differences in spectral distribution, the appearance of an object

* Manchester staff, North Western Electricity Board.

seen under the two illuminants may vary noticeably. For instance, the "daylight" fluorescent lamp is, in appearance, an excellent simulation of north sky daylight, but it makes blues appear more vivid and also imparts a greenish tinge to some other colours. This lamp, therefore, would be doubly disqualified for domestic lighting; first because of its rather cheerless appearance when used to provide relatively low intensities and, secondly, because of its tendency to distort the colours of garments and furnishings.

With such lamps as the "warm white" and "peach," this tendency towards colour distortion is not so noticeable, and these lamps are generally acceptable for social interiors, though certain fabric colours, particularly blues, are occasionally maltreated. The "mellow" lamp was designed specifically to provide good colour rendering for foodstuffs and complexions, but most clothing and furnishing fabrics escape serious colour distortion under its light.

No Radical Change

Since the recent history of illumination has demonstrated the preference for the warmer "approaching" colours, domestic lighting may not suffer the radical change that was suggested by the introduction of the "daylight" fluorescent lamp some twelve years ago. The textile manufacturer may, therefore, be safe in assuming that his colours are likely to appear under the illuminants of the future much as they appeared under the illuminants of the past, but a little care may be necessary to avoid certain dyes which may cause trouble with blue and blue/green fabrics when these fabrics are seen under fluorescent lighting.

Artificial light can, however, affect not only the apparent colour of fabrics, but also their form and texture; so it is necessary to sound a warning note concerning the use of large sources, such as the fluorescent lamp. By the correct placing of such sources virtually shadowless lighting can be achieved but while this may be desirable in some interiors, it can also result in a "flattening" of the visual scene, causing objects to lose that modelling which is so essential to the proper appreciation of their form. This is particularly important where fabrics are concerned. The display artist knows this and uses strongly directional light to show up the folds of draped materials. This should be borne in mind when planning such devices as pelmet lighting where lamps are used specifically for the illumination of curtains. While, therefore, fluorescent lighting may make the domestic interior appear more spacious, it may also make it appear less interesting and the use of this type of lighting alone is rarely successful where a decorative effect is desired.

The effectiveness of light and shade is also apparent in the texture of some fabrics when they are seen under appropriate light. In the case of such materials as damasks, the elegance of the weave is only seen to the best advantage when the incident light is directional in character. Interesting results can be obtained by experimenting with such materials displayed at various angles to the line of sight.

It is apparent, therefore, that the appearance of furnishing fabrics, garments and carpets is dependent not only upon their intrinsic qualities, but also upon the characteristics of the illumination under which they are seen. For their appearance to be fully effective, co-operation is needed from the textile manufacturer, the lamp manufacturer and those who are concerned with applying light sources to domestic purposes.

So often the lighting of our homes receives little study. It is a cause for wonder that, in an age when women are concerning themselves more and more with technical matters, the illuminating engineering profession has not yet attracted a significant number of women to its ranks. It is commonly held that women have a better "sense of colour" than men and, since effective lighting is often only achieved by the mingling of art and science, it seems desirable that girls entering the electrical industry should be urged not to overlook the possibilities of interesting work in illuminating engineering.

Colour and Physics

FUTURE printings of the book "Physical Aspects of Colour," by Dr. P. J. Bouma, reviewed in this journal on 25th March, 1945 (page 485), will contain a plate in full colour representing the distribution of chromacities in the colour triangle. Cleaver Hume Press, Ltd., 42a, South Audley Street, London, W.1, who distribute the book for N. V. Philips' Gloeilampenfabrieken, Eindhoven, have a small supply of loose plates which they will send, while numbers last, to any owner of the book on receipt of 6d to cover postage and packing.

Commerce and Industry

Non-Ferrous Metals Shortage

Birmingham Productivity Methods

REFERRING to a statement by the Minister of Supply in the House of Commons on the national supply position of certain non-ferrous metals in 1951, the British Non-Ferrous Metals Federation declares that the prospective shortages of copper and zinc, if not rapidly alleviated by national or international action, must result during the next few months in widespread redundancy of labour and in a serious decline in production in all metal-making and metal-using industries. The impact of this is all the graver in view of the assurance given by the Minister as recently as 25th August, 1950, that ". . . ample stocks of copper, lead and zinc will be available to meet consumers' current requirements as they arise. . . ."

While the Minister stated that measures to ensure proper distribution were ". . . under consideration in consultation with industry . . .", such consultation extends only to what now has to be done and the Minister has not at any time called for the advice of metal consumers in carrying out his bulk purchasing policy.

In the joint communiqué issued since the Minister's statement by the President of the United States and the Prime Minister, we are promised ". . . international action to ensure that basic raw materials are distributed equitably. . . ." The non-ferrous metals industry confirms its readiness to co-operate fully in any such measures, and makes an urgent plea for consultation with industry at every stage.

Packaging Course

A second course for junior executives will be held by the Institute of Packaging from 12th to 16th March inclusive at Shell Mex House, Strand, London, W.C.2. Applications must be submitted by 12th February and forms can be obtained from the secretary of the Institute, 55–61, Moorgate, London, E.C.2 (telephone : Monarch 6226).

Imported Copper Quota

The Ministry of Supply announces that from 1st January until further notice supplies of imported virgin copper to consumers will be restricted to a total each month equal to their average monthly consumption in the first half of 1950. Consumers of imported electrolytic copper in special shapes and to special specifications will be restricted to a monthly quota of two-thirds of their average monthly consumption of these shapes in the first half of 1950. The quota may be made up, if the consumer desires, by deliveries of standard shapes, subject to the overall limitations on supplies notified above.

Jackson cookers at an Agricultural Show in Kenya

Electric Cookers in Kenya

At a recent Agricultural Show at Nakuru, Kenya, the British East Africa Corporation had a large stand. A part of it was devoted to a display of Jackson cookers (Nos. 194, 192 and the "Giant"—No. 69) and we reproduce a photograph of the cooker display taken during the show.

Productivity Exhibition

With a view to showing how some firms in the Birmingham area have successfully approached the problem of increasing productivity and to demonstrate the methods they have used, a Productivity Exhibition, organized by the Birmingham and District Advisory Committee of the Midland Regional Board for Industry and produced for them by the Economic Information Unit and the Central Office of Information, is being held at the Birmingham College of Technology from 29th December to 6th January. A number of organizations are taking

part, including the Institution of Production Engineers, the Institution of Engineering Inspection, the Institute of Welding, and the Midlands Electricity Board, while support is being given by other bodies, including the F.B.I., the Institution of Industrial Administration (Birmingham Centre), the Institute of Industrial Supervisors and the Institution of Works Managers (West Midlands Branch).

There will be a section showing the approach to good method, another devoted to mechanically-operated jigs and fixtures, work holding devices, the use of progressive dies, material handling equipment, the latest cutting tools and machining methods, and heat treatment. Other displays will show the use of rolled metal sections to eliminate machining, fabrication by welding, and the application of quality control methods. The importance of safety will be demonstrated in a section by the Factory Inspectorate, and the value of effective lighting in achieving increased productivity will also be a feature.

Railway Signalling

Addressing the Institution of Railway Signal Engineers, Lord Hurcomb, chairman of the British Transport Commission, said that they could only regret that the re-equipment of the railways had been, and was still, restricted by subordination to the general economic requirements of the country. A considerable amount had, however, been done towards bringing signalling up to date. In 1949 alone £650,000 was spent on additions and improvements to signalling and telecommunications equipment. The signalling work for the Liverpool Street–Shenfield line cost over £1½ million and the Bricklayers Arms and Battersea Park to Coulsdon signalling system, which was now proceeding, was estimated to cost about the same amount. The scheme, when complete, would give colour light signalling all the way from Victoria and London Bridge to Brighton. These were large sums but it was only modern signalling methods, such as automatic and semi-automatic sections of colour light signalling, that could enable more intensive services of passenger trains to be run at closer intervals and with immunity from accident which was almost complete, though it could never be absolute.

The Post Office in 1950

An account of the manifold activities of the Post Office is given in "Post Office 1950" which has just been published by H.M. Stationery Office at 2s 6d. This contains a chapter on the work of the Engineering Department and the Research Station at Dollis Hill. It describes the efforts being made to improve the standard of telecommunications, and shows how the Research Station is assisting to this end. The structure of control of the Post Office is dealt with and there are also chapters devoted to the problems and achievements in the inland and overseas telecommunications fields. Among other matters covered are personnel and accommodation, and supplies and maintenance. The book is profusely illustrated.

New Year Holiday

The works of Bruce Peebles & Co., Ltd., Edinburgh, will be closed for the New Year holiday from 29th December to 4th January.

Lighting at Trafford Park

The new Metrovick lighting on the Westinghouse Road flanking the northern boundary of the main Trafford Park Works of Metropolitan-Vickers Electrical Co., Ltd., has been installed with the company as main contractors. "Trafford" lanterns are erected on steel columns down one side only of each of the two carriageways. Every day at 5 o'clock 200 buses move more than 10,000 people from this terminus in 12 minutes.

The road itself was named after George Westinghouse, the founder of the Metropolitan-Vickers Electrical Co., Ltd., under its original name of the British Westinghouse Electric and

Metrovick lighting, Westinghouse Road, Trafford Park

Manufacturing Co. The "Trafford" lantern introduced in 1938 is claimed to have been the first totally enclosed bowl refractor lantern to be produced in this country using the mercury discharge lamp horizontally.

Radio Research

The report of the Radio Research Board for the period 1st October, 1933, to 31st December, 1948, has just been published for the Department of Scientific and Industrial Research by H.M. Stationery Office, price 2s (50 cents U.S.A.) by post 2s 2d. This 59-page publication includes a survey of the investigations carried out during the years 1934–1947 together with the report of the director of radio research for the year ended 31st December, 1948. Up to 1933 the activities of the Radio Research Board were described in a few special reports and after that in the annual reports of the National Physical Laboratory, where the majority of the radio investigations have been carried out. An extended programme of research was started in 1949 and in future the progress of the work will be reported annually.

Trade Announcements

A. B. Metal Products, Ltd., who moved to a new factory at Ynysboeth, Abercynon, Glamorgan, in August last, has extended its works by the acquisition of an additional factory. The works in Wales now cover an area of 72,000 sq ft.

Mr. G. Allin has been appointed district engineer for **Wm. Sanders & Co. (Wednesbury), Ltd.**, in the counties of Lincoln, Nottingham, Derby, Leicester and Rutland, the borough of Burton-on-Trent, the urban district of Uttoxeter, and the Soke of Peterborough.

Armstrong Siddeley Motors, Ltd., Coventry. has arranged with Diesel Equipment, Ltd., Uxbridge, for the latter company to manufacture a range of generating and lighting equipments incorporating exclusively the Armstrong Siddeley diesel engine. This range will be very comprehensive, covering marine and industrial equipments, hand starting, electric starting and fully automatic, from 3 kW up to and including 10 kW.

The address of **Austin Taylor Electrical, Ltd.**, is now Ellesmere Street, Failsworth, Manchester (telephone : Failsworth 2360).

Catalogues and Lists

Automatic Telephone & Electric Co., Ltd., Strowger Works, Liverpool, 7.—Leaflet on a magneto mining telephone.

Porter Electrical Products, Ltd., Bramhope, Leeds, Yorks.—Leaflet on the "Portaway" earthing system.

Thos. Handley & Co., Ltd., Britannia House, 74, Wellington Street, Leeds, 1.—Folder announcing the price reduction of "Ebor" candle lamps.

Queensbury Engineering Co., Ltd., Cumberland Road, Stanmore, Middlesex.—Two priced catalogues on fluorescent lighting fittings and "Edgeray" illuminated signs.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.—Two wall charts on "Tungar" battery chargers and 6 V and 12 V vehicle batteries; also catalogue of traction batteries, priced folder on motor lamp bulbs and leaflet on television interference suppressors for motor vehicles.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within a month of 6th December :—

SOLIS (design). No. 667,447, Class 9. Electrical apparatus and appliances and parts; electric cables, heating elements included in Class 9, and thermostats. SOLIS (design). No. 667,448, Class 10. Electrical apparatus and appliances included in Class 10 for surgical and curative purposes, heating cushions and heating pads, appliances for massage and electrically heated blankets, and parts. SOLIS (design). No. 667,449, Class 11. Hot and cold air blowing installations and air drying installations and parts, ventilators, heated footrests and electric heating elements included in Class 11.—Dr. W. Schaufelberger & Co., Zurich, Switzerland. Address for service, c/o Baron & Warren, 16, Kensington Square, London, W.8.

WATERLIGHT (design). No. 686,748, Class 9. Electrically operated signs.—Othmar Angerer, Lucerne, Switzerland. Address for service, c/o E. Fonseka, 105, Elliscombe Road, Charlton, London, S.E.7.

HILGER (design). No. B689,179, Class 9. Gauging, measuring, scientific and optical apparatus and instruments. No. B689,180, Class 10. X-ray apparatus.—Hilger & Watts, Ltd., 48, Addington Square, London, S.E.5.

MEMERA. No. 691,031, Class 9. Electrical apparatus and instruments included in Class 9, radio sets (complete) and parts of all such goods included in Class 9.—Midland Electric Manufacturing Co., Ltd., M.E.M. Works, Reddings Lane, Tyseley, Birmingham, 11.

SCREENECTOR. No. 691,303, Class 9. Electronic apparatus and parts thereof, all included in Class 9.—Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

DEXALOY. No. 691,341, Class 9. Electrical apparatus and instruments included in Class 9, etc.—Norman Kershaw, 474, Street Lane, Leeds, 7.

HENRAY COM-BO. No. 691,405, Class 9. Combined vacuum cleaners and floor polishers for domestic use.—Henray Electrical Co., Ltd., 1, Leadenhall Street, London, E.C.3.

S (design). No. 668,690, Class 11. Incandescent electric lamp sockets.—Wm. Sanders & Co. (Wednesbury), Ltd., Ridding Lane, Wednesbury, Staffs.

SIMCELL. No. 691,402, Class 11. Electric light fittings.—Simplex Electric Co., Ltd., Broadwell Road, Oldbury, nr. Birmingham.

Transformers for Export

First of Five for 230 kV for Finland

WHAT is believed by its makers to be the first three-phase 230 kV power transformer to be exported from England was due to be shipped this week. It is the first of five similar units which Ferranti, Ltd., have on order for Finland and is for installation at the Imatra Power Co.'s Pyhakoski generating station.

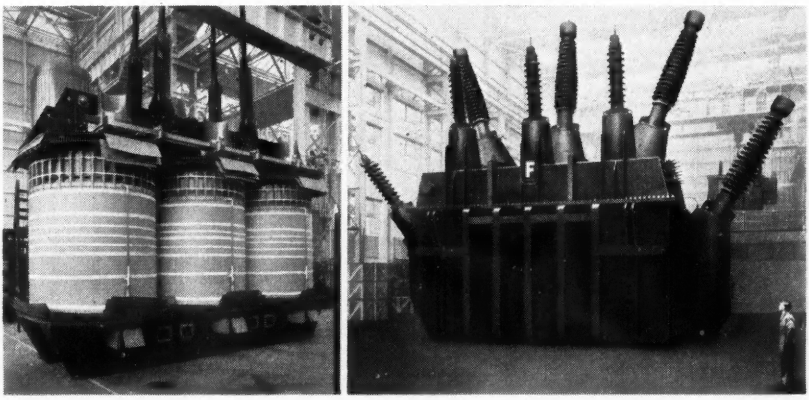
Three windings are provided, rated respectively for 64/64/32 MVA, the voltage ratios being 115·5/231/10·5 kV between phases. Both the 115·5 and 231 kV windings are star connected with the neutral ends fully insulated. The 32 MVA 10·5 kV winding is to supply three 10,000 kVA reactors to compensate for the capacitive load of the 220 kV transmission lines. The transformer is rated for the full loadings to be applied on all windings simultaneously. Tappings are provided on the 115·5 kV windings for off-circuit changing by hand operated tapping switches.

In all respects, except for voltage tests, the transformer is designed to British standards, the voltage tests being in accordance with Swedish rules. To satisfy these the 231 kV windings were designed for and tested at 530 kV, 50 c/s, which is the highest 50 c/s test voltage so far applied in this country to a transformer, either single-phase or three-phase, from a separate source. The test voltage on the 115·5 kV windings was 275 kV 50 c/s.

The transformers are of the B.S. ON/OFB type, cooled by forced oil circulation with two banks of air blast cooled radiators adjacent to the transformer. With the Ferranti directed flow system the cooling oil entering at the bottom of the tank is not discharged into the general column, but is led directly into the end clamps. From these the oil feeds a distribution chamber which delivers oil to the axial ducts of each winding in predetermined proportions.

The latter are provided with directing barriers so that the oil flows alternately from the inner to the outer duct, and then from the outer to the inner, through the radial winding ducts. This positive flow through the radial ducts reduces the difference in temperature between the windings and oil, so the rise in oil temperature between inlet and outlet is uniformly low in all windings, the difference between the mean and maximum oil temperatures in the transformer tank being only 2 or 3 deg C at full load. In

Windings of three-phase 230 kV power transformer and (right) complete transformer in makers' works after final test, before dismantling for shipment



consequence the hot spot temperature of the "OFB" transformer is only 3 or 4 deg C higher than the temperature as measured by resistance of the windings. The rating of the transformer when operating "ON" is 66·2/3 per cent of the rating "OFB."

The transformer in its tank complete with bushings, but exclusive of the radiator banks, is 30ft high, 35ft 3in long and 11ft broad; the weight, including oil, being 176 tons. The service dimensions, including radiator banks and cooling gear, are 30ft high, 51ft 3in long and 28ft broad.

Although there is no difficulty in lifting the complete transformer at the Ferranti factory, the present limit in lifting capacity at the port of Abo, Finland, and of rail transport in Finland, is 90 tons, so it has been necessary to dismantle the transformer for shipment into units which do not exceed this limit. The core and windings were to be shipped in a special transport tank built round them and hermetically sealed, while the actual service tank and service cover were each being shipped separately.

Special routing has been necessary to avoid bridges between the works and Manchester Docks where the transformer was to be loaded for Finland. At one spot it was necessary to raise the trolley wires where the route to the docks crosses the route of a trolley-bus service. The shipping of the main tank and service cover separately was done in order to clear G.P.O. telegraph wires en route to the docks.

In Finland the journey from Abo to Pyhakoski will be made by rail, using special trucks to suit which the transformer tank has been shaped. The final tanking and assembly with the necessary vacuum filling will be carried out on site by Ferranti engineers.

Area Activities

Electricity Boards' Reports for 1949–50

EASTERN

HOUSING, rural supplies, industrial expansion and railway electrification all contributed to load development in the Eastern Area during the past year and further substantial additions are foreshadowed. Besides many new housing schemes, including an L.C.C. estate at Harold Hill where 7,000 domestic premises are to be erected, together with shops, schools, etc., six new towns are to be built in the Board's Area. General schemes have been planned for three of these—Harlow, Hemel Hempstead and Stevenage. Harlow will be supplied at 33 kV from the new Rye House power station and the other two from 132 kV grid connections.

For the Liverpool Street–Shenfield railway electrification a 16,000 kW supply was made available by 33 kV feeders from Barking power station. Industrial schemes included an initial supply of 3,000 kW to a large factory which will require some 7,000 kW by 1952; and an additional supply of 8,000 kW to a factory already taking 13,000 kW. In the rural areas supplies were made available to 146 villages and hamlets and to 1,277 farms (making the total of the latter 12,704). The aggregate number of consumers of all classes at the end of March was 1,284,842, an increase of 53,488. The total length of h.v. and l.v. mains and cables put into service during the year was 1,012 miles compared with 805 miles in the Board's first year.

Sales of appliances and the amount of contracting work undertaken showed a marked increase, the turnover amounting to £3,856,970—£1,057,407 more than in the previous year.

EAST MIDLANDS

The bulk of the representations made through the Consultative Council in the East Midlands Area last year were concerned with rural supplies. The Board had already approved comprehensive schemes in Lincolnshire, but preliminary work on these was hindered by delays in the delivery of overhead line insulators. For the whole Area, a survey put the cost of rural development at some £12 million, of which £2½ million would be required for 33 and 11 kV mains and spur lines. During the year the Board approved schemes to the extent of £675,000. Farms receiving a supply at the end of March numbered 12,899, an increase of 993. Of the 18,500 farms not connected the majority are some distance from the mains.

On the industrial side, the increasing electrification of collieries was a major factor in load development. Ninety new agreements were made for large industrial supplies aggregating 40,000 kVA, of which colliery supplies accounted for 22,000 kVA. Negotiations were continued with the National Coal Board for taking over supplies to villages served by adjacent colliery plants, and arrangements were completed for the transfer to the E.M.E.B. of the supply to Binley, near Coventry.

In view of the public demand for the continuance of simple hire the Board put into operation a uniform scheme for the hire of cookers under which two sizes are offered at quarterly rentals of 12s and 14s. A similar scheme for wash-boilers is being investigated. Purchases by consumers under the credit sales scheme totalled over £420,000 and at the end of the year this facility was extended to include assisted wiring. On installation work the Board's policy is to continue but not extend existing departments unless an undoubted need is proved. Five contractors' circles have been set up, each composed of six representatives of the Board and six of the E.C.A.

At the end of March last consumers served by the Board numbered 968,486, an increase of 33,356 during the year.

With regard to system development, two new bulk supply points were brought into use (one at Staythorpe and a temporary supply point at Willoughby) making 23 in all. Work was started during the year on a new substation and overhead line connection for a 132 kV supply to Rugby. A scheme for a 132/33 kV substation at Langham, near Oakham, planned before vesting day, was stopped in favour of new supply points at Boston and later at Grantham.

Besides purchases from the Central Authority the Board obtained 6·8 million kWh from the Renishaw Iron Co., Ltd., by way of waste heat generation, the average price paid being 0·335d/kWh. An agreement was also made with the Sheepbridge Co., Ltd., involving the output of a 6,000 kW set and another with the East Midlands Gas Board for purchasing surplus energy from the Northampton gasworks.

Sales of Electricity and Price per kWh Sold in 1949-50 (1948-49 in italics)

Board	Total Sales		Domestic 2-Part Tariff		Large Power	
	Mill. kWh	Price d	Mill. kWh	Price d	Mill. kWh	Price d
Eastern	3,536·7	1·35	1,430·5	1·31	1,305·8	1·06
	3,308·2	*1·31*	*1,379·9*	*1·21*	*1,168·6*	*1·08*
E. Midlands	3,166·9	1·15	891·8	1·11	1,722·7	0·93
	2,939·3	*1·14*	*903·8*	*1·01*	*1,616·2*	*0·98*
Midlands	4,301·2	1·09	1,018·1	1·11	2,557·9	0·88
	4,058·7	*1·07*	*1,012·4*	*0·98*	*2,350·0*	*0·89*

MIDLANDS

A point of interest in the Midlands Board's report concerns the purchase by the Board of the remaining assets—land and buildings at Stourport, Worcs—of the S.W. & S. Development Co., Ltd., vested in the B.E.A. The land was first bought for industrial development and some of it was sold as factory sites. The remainder includes a farm where, by arrangement with the tenant farmer, a model electric dairy will be available for demonstration.

Farming and rural supplies, in fact, figure largely in the Board's plans, in spite of the industrial character of much of the Area. A survey to ascertain the cost of " backbone and ribs " distribution extensions to bring all premises within at least a mile of a h.v. line indicated that expenditure would be in the neighbourhood of £5 million. This would bring in only another 41,000 consumers with an estimated annual revenue of £500,000. The number of farms connected during the year was 1,203, making 10,203, excluding those in a section of the Area transferred to the South Wales Board. In all, new consumers numbered 42,612 and the total at the end of March last was 1,013,105.

As with other Areas, extensive reinforcement of the distribution system is urgently required, involving heavy capital expenditure. In many places the old bitumen cables are still in use, and large numbers of switches remain to be replaced by more modern equipment. There is also the change-over to the standard a.c. system, estimated to cost £5·3 million. At the end of the year there were 62,030 d.c. consumers.

Major reinforcement of the supply to Herefordshire is a matter of urgency, but this has been held up by objections to a 66 kV trunk line over the Malvern Hills.

Referring to the revised bulk supply tariff, the report says that as compared with the tariff in operation in 1948–49, the total increase to the Board in 1950–51 is estimated to amount to £1,504,000.

Sales of appliances during the year included 11,423 cookers, 3,452 water-heaters, 3,676 washing machines, 3,609 wash-boilers, 1,619 refrigerators, 2,942 radio and television receivers and 25,650 other items.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Fluorescent-Tungsten Lighting

MR. SAWYER takes me to task for not basing my comparisons on higher domestic tariffs. Well, let us do so. But first, in fairness to the G.E.C. let me make a correction. My lamp replacement costs were based on Philips ballast lamps and normal fluorescent lamps. Actually the cost of lamps and ballasts as given by the G.E.C. is 30s per 3,500 hours instead of 39s 4d.

Now, comparing pence per lumen and 3,500 hour running costs for 4,310 lumen output (the Philips fitting with "mellow" lamps), we get these figures for 1d, 2d and 4d per kWh :—

Lamp circuit	1d per kWh		2d per kWh		4d per kWh	
	d/ lumen	Total s	d/ lumen	Total s	d/ lumen	Total s
Philips	0·427	153	0·609	218	0·979	352
G.E.C.	0·364	127	0·548	197	0·919	330
Tungsten	0·343	124	0·619	222	1·168	419
Fluo. q/s	0·299	108	0·441	158	0·730	262
Fluo. s/s	0·287	104	0·424	152	0·686	246

On this basis with electricity at 2d and 4d per kWh respectively, maintenance costs of these new fittings are 66s and 105s higher than conventional fluorescent circuits over a period of one lamp life. Surely this makes my point stronger. My criticism relates not to the new circuits against tungsten lamps but to the new circuits as compared with established fluorescent practice.

The cost of the Philips "Alva" lamp is £10 7s 6d and it has a lumen output of 4,310 at an average efficiency of 19 lumens/watt. A new fitting, just announced—the "Atlas" GK/4240 (with a conventional choke control circuit)—costs £12 0s 8d and has an output of 4,080 lumens at 21·4 lumens/watt. The running costs for this fitting over a period of 3,500 hours, according to my calculations, are 273s, bearing in mind that it uses four 2ft lamps with electricity at 4d per kWh. This represents a saving during the first 3,500 hours of nearly £4 on the Philips fitting.

Granted that these chokeless fittings are more economical than tungsten lamps for the rapidly diminishing number of consumers who still pay much more than 1d per kWh, it is surely false economy to save less than £2 on the initial cost of the fitting to incur up to £5 additional running costs during the first two years of its life.

SIGMA.

Remedies for Power Cuts

STATEMENTS made recently by various officials of the B.E.A. seem to indicate that the present dreadful state of the electricity supply industry can be expected to continue for at least another five, and possibly ten, years. When we consider that before the war the main object of every supply engineer was continuity of supply, it seems very wrong that we should now have to put up with sudden interruptions of supply, low voltage and low frequency, with all their attendant trouble, annoyance and inconvenience.

If the Government cannot permit the capital expenditure necessary to provide enough new power stations, there are possible ways of meeting the situation, and I suggest that the following merit consideration:—

(1) *Limitation of new connections.*—Electricity is better than anything else for lighting, heating and motive power, but it can hardly be said to be much better than gas for cooking and I suggest that the refusal of any further cooking connections for the present would assist matters and create no hardship except to the manufacturers of cookers. It does seem silly that Electricity Board showrooms should be trying to capture the cooking load from the Gas Boards at the present time.

(2) *Supplies from the Continent.*—I believe I have seen it stated that France, with her hydro-electric supplies, has a surplus of energy in winter (when we are short) and a shortage in summer (when we have it to spare) and I should think it likely that the peak load in France occurs at an earlier hour each day than it does here, partly

because of the time difference and because most Frenchmen start work earlier.

If these premises are correct, it would seem that a submarine cable across the Channel might bring France's surplus to us when we need it and take our surplus to France when she needs it, at a much lower cost than the equivalent capacity in generating plant. As an experiment, a temporary single-core cable with earth return and single-phase to three-phase transformation at each end might at least help matters in the London and South Eastern Areas.

I should be very interested to know what any other readers, with greater technical and financial knowledge of such matters than I possess, have to say on the subject.

*London, E.C.*1. J. DAYES.

Water Heating

YOUR report of the sixth meeting of manufacturers' representatives with the South Eastern Electricity Board (20th October issue) included some interesting remarks by the deputy-chairman of the Board, Mr. W. R. T. Skinner. who referred, among other matters, to the predicament in which electric water heater manufacturers find themselves as a result of the purchase tax situation. The manufacturers would perhaps refer to their predicament in stronger terms in which "major embarrassment" would appear in place of "discomfiture." The latter could apply to consumers, and perhaps to the conscience of a public board, for they must realize that water heating is one of the finest services which electricity has to offer; also one which in a long-term policy could yield a very desirable off-peak load for the supply authorities.

Such development must necessarily be a long-term policy and the present transitory embarrassment of system peak, and the collection of tax, should not jeopardize such a policy if agreed as right. Neither the tariff, nor the design of suitable equipment which is influenced by it, takes place in short-term stages which only result in chaos, as would be the result if such a policy were pursued with regard to generating plant for instance.

Colenso, Natal, South Africa. V. S. LAKE.

Television Transmitter Feeder

THE inspection and rehabilitation of the main antenna and antenna feeder of the television broadcasting station at Alexandra Palace, London, has just been made without interrupting the service. The solution of the problem was eased by the availability of a medium-sized semi-air-spaced cable recently introduced by the Telegraph Construction and Maintenance Co., Ltd.

This cable, Telcon Type AS.84.A1, has a number of advanced features and has probably the highest power rating of any cable of a quality suitable for use with television at very high frequencies. The two cables in the present installation can carry up to 20 kW (peak white) at 45 Mc/s. The inner conductor is a solid copper wire of just over 0·25in diameter. The insulation is formed by the assembly of a series of interlocking semi-cylindrical thimbles of low loss which form a smooth cylindrical surface on the outside of the core and provide a robust support for the inner conductor at frequent intervals.

The outer conductor is a seamless extruded tube of high conductivity aluminium, which is applied to the core by the Johnson & Phillips process. This provides an efficient return conductor and an effective screen at all radio frequencies, and at the same time serves as a watertight sheath to protect the semi-air-spaced insulation. Its robustness and light weight permit it to be installed up masts without the usual steel wire armour. Recently a 500ft length of similar cable was successfully pulled directly up one of the B.B.C.'s guyed masts. The normal corrosion-protective servings, comprising bitumenized papers and hessians, are used.

The degree of electrical uniformity of propagation characteristics, so important for broad band transmission such as television, is remarkably good. Tests by the B.B.C. on a 280yd length indicated that with a correctly-terminated load, the voltage standing-wave ratio would not be worse than 0·98 over a 10 Mc/s band centred on 60 Mc/s.

Railway Electrification

THE electrification of the railway from Glasgow Central Station to East Kilbride is being proposed by the Development Corporation of the new town. Representations are being made to the Transport Commission and British Railways. They point out that electrification would increase the traffic on the railway which would, in turn, reduce bus and motor congestion in Glasgow.

Water-Power Plant

Review of Methods of Control

THE growing need to develop every practical source of power is causing the control of water power plant to be looked at from fresh points of view, involving consideration of uniformity and economy of operation, maintenance staffing and the most efficient use of the catchments of each river system as a whole.

In their examination of the subject Messrs. A. C. H. Frost and W. Brittlebank (Messrs. Merz and McLellan) outlined in a paper presented to the Institution of Electrical Engineers available methods of controlling individual hydro-electric plant. Some typical schemes were described, but no attempt was made to give full details of the various possible circuits that might be employed, or the mechanical design of governing systems.

The more popular variations of manual, "cottage-attended," semi-automatic, fully automatic, supervisory and light current direct control systems were tabulated and commented upon. Emphasis was laid upon the development of sequential-parallel automatic control and the reasons why it was preferred. Some practical aspects of the apparatus involved were described, and operating and maintenance requirements were also examined.

DISCUSSION

Mr. T. G. N. Haldane (Messrs. Merz and McLellan) opened the discussion with the observation that hydro-electric plant characteristically lent itself to simple control and rapid response to load requirements. The Galloway scheme had demonstrated the advantages of remote and semi-automatic control. It could be laid down as a broad principle that any hydro-electric plant, provided that it was not subject to hydraulic restrictions and that the transmission distances were not excessive, should be designed for peak load operation, which called for remote and semi-automatic control. So used, it would enable the thermal plant to be operated to the best possible advantage.

Mr. A. R. Cooper (B.E.A., Merseyside and N. Wales) suggested that the outstanding success of the semi-automatic control gear on the Galloway scheme was largely due to the very high quality of the maintenance. The shift staffing of steam power stations, even in urban areas, was becoming increasingly difficult and it was still more difficult to get people to work shifts in isolated surroundings. He was not sure whether this made the case for completely automatic control, or for no control at all, with gangs of men to create a social atmosphere.

Mr. A. T. Mitchell (Boving & Co.) emphasized the importance of the governor oil pressure and its maintenance in an emergency. The house set had the great advantage of being available at all times to carry all the local load of the station, which meant that in an emergency the normal lighting was maintained, all the usual auxiliaries could be run and re-starting differed in no way from normal. He hoped that the paper would eventually lead to simplicity and uniformity of control schemes by the adoption of standard systems.

Starting-Up Time

Mr. F. H. Williams (B.E.A., Galloway) said that while the Glenlee station, of 24,000 kW, could be started up and be on full load on the grid in about three minutes, the automatic stations took more than twelve minutes to get away, because the first part of the starting up was the filling of the pipeline. It was their considered opinion that in automatic stations which had propeller-type runners with fixed blades automatic synchronizing would not enable them to get away more quickly.

Their governors were gear-driven and they had never had any trouble with them. So far as electrical drive was concerned, their experience was that the fewer electrical "gadgets" there were on a hydro scheme the better. The atmosphere was always humid and a certain amount of heating had to be put in to keep the electrical apparatus in good condition. Automatic stations were excellent, provided all the equipment was first class and there was a good maintenance staff. He did not agree that it was unnecessary in an automatic station to have someone permanently on the premises.

Mr. E. M. Johnson (Metrovick) regretted that the paper had been confined almost entirely to the use of hydro-electric power to provide peak assistance to bulk generation by thermal plant, excluding plant which might be regarded as a by-product of irrigation, inland navigation and flood control schemes, and also that used in countries where there was no practicable alternative to water power. A very large part of the world's hydro-electric plant ran for the most part continuously and did not possess the elements which the authors rightly emphasized as necessary for the type of system which they described.

Mr. B. Donkin (Messrs. Kennedy & Donkin) agreed with the authors that station auxiliary sets were an expensive luxury. Loads had a habit of increasing more rapidly than generating plant and, in general, it was more economic to supply local loads by enlarging the unit auxiliary transformers associated with the generators or the line transformers.

Mr. N. G. Dennis made a number of detailed comments from the turbine maker's point of view.

Mr. J. F. Fletcher (Standard Telephones) mentioned that the method known as light-current direct control was being increasingly used and was employed for the largest of the new Scottish hydro-electric stations. He suggested that meter manufacturers and telecommunication engineers should get together to design a sort of telesynchroscope to permit synchronizing over considerable distances.

Mr. H. Headland (Messrs. Kennedy & Donkin) thought the reference to pumped storage schemes in the paper a little cursory and suggested that the development of a machine which could operate both as a turbine and as a pump might easily change the economic case for pumped storage in this country.

Mr. G. Gerard, speaking as an operator, emphasized the need to keep electrical equipment in hydro-electric stations as simple as possible. He agreed that governors operated by belts worked very satisfactorily, while in some stations where electric motors were used for this purpose there had been several shut-downs as a result. It was important, he said, that electric motors operating governor oil pumps should be of a latching type, as otherwise they would trip out if there was a surge on the system. For governor oil pump operation the best arrangement was a small Pelton-driven oil pump to operate in an emergency or to run in parallel with the electrically-driven auxiliaries. Control circuits going to reservoirs should be routed so that they could not be damaged by a burst pipe or dam.

Dr. J. H. Walker said that some specifications provided that machines should operate in parallel with two or more machines solidly earthed at the same time. That meant difficulties for the machine designer, because of the third harmonic currents involved, and there was a risk of damage to the machine due to the heavy currents which could flow if there was a fault on the line or the machine. Resistance earthing was expensive and bulky. The alternative of earthing the neutral through a high voltage distribution transformer from which warning relays of earth currents could be operated could lead to trouble if this transformer and its associated apparatus were not correctly designed.

Mr. J. F. Shipley said that when installing hydro-electric plant in West Africa his firm had found it more economical to install completely automatic stations, in spite of the difficulties due to dust, humidity and insects, than to have three white attendants at each station. In the eleven years for which the plant had operated for 24 hours a day there had been only ten breakdowns, all of a minor character.

Heat Transfer Methods

IN a paper to the Institution of Heating and Ventilating Engineers Mr. R. A. Rose surveys the accepted methods of heat transfer and enumerates several industrial processes which require temperatures of the order of 300 deg F, and which until recently could only use either high-pressure steam or high-pressure hot water as the heating medium.

The development of new liquids as heating media for high-temperature operation has made rapid advances and an installation in a London distillery is described which uses tetra cresyl silicate as the heating medium in place of the original method of direct hand firing. The author outlines the physical properties of this liquid and shows that it has a considerable temperature range between 1 deg F and 815–825 deg F. It meets all standard temperature requirements and can be handled throughout its temperature range by accelerators suitable for high-pressure hot water subject to slight gland modifications.

The remainder of the paper is devoted to a detailed description of the plant at the distillery which is shown to operate entirely satisfactorily.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Tube Investments, Ltd.—At the annual meeting held on 13th December, Mr. I. A. R. Stedeford (chairman), who presided, in the course of his speech said that over the past year or so they had been introducing into some of the factories the newest techniques in standard costing and budgetary control. Their experience with these methods already endorsed the recommendations of the productivity team which visited the United States to study management accounting. The residential training centre for supervisors opened two years ago had proved to be of great value in helping their supervisors to adjust themselves to their new responsibilities. Each of the five divisions of the group had made its contribution to the record results they had achieved during the year. The electrical division, which produced the Creda and Simplex products, had improved its contribution to the group's results and had gained a fair share of the available trade, both at home and overseas. The direct exports of the group during the year totalled £14 million and were 10 per cent better than the previous year's record. Sales to Canada and the United States and to other dollar account countries were 60 per cent higher than in 1948-49.

Their five-year plan for technical development was about completed. Since 1945 about £15 million had been spent in developing and expanding T.I. trade. They had now decided to embark upon a second home development plan involving an expenditure of about £10 million over the next three years or so. They proposed to increase the authorized capital by £10 million and to issue for cash as soon as possible five million £1 4½ per cent preference shares.

Crabtree Electrical Industries, Ltd.—Speaking at the annual meeting held on 7th December, Dr. H. Schofield (chairman) said that the record trading profits for the year under review had been achieved despite violent fluctuations in prices of raw materials and considerably increased prices of non-ferrous metals. They had experienced difficulty in obtaining sufficient labour and to meet the position they had spent large sums on providing new mechanized foundry equipment and also on the development of improved production methods throughout their factories, and they were now benefiting from these changes. Their South African subsidiary had achieved better results this year, although developments in this sphere had not proceeded as fast or as successfully as they originally hoped.

Solus Teoranta (the Irish lamp-making concern) is paying an unchanged interim dividend of 5 per cent.

Waygood-Otis, Ltd., has declared an interim dividend of 30 per cent (against 20 per cent).

New Companies

Rynford Industries (1950), Ltd.—Registered 6th December. Capital £3,500. To acquire the business of Rynford Industries carried on by F. W. A. Williams, A. C. Brooks, J. C. Knuckey, C. Simpson and W. E. Teague at West End, Redruth, Cornwall, and to carry on the business of manufacturers of and dealers in electrical and mechanical apparatus and accessories, etc. Directors: J. C. Knuckey (chairman), A. C. Brooks, W. E. Teague and C. Simpson. Regd. office: 56, West End, Redruth.

Electromotives (Croydon), Ltd.—Registered 5th December. Capital £100. Electricians, mechanical engineers and manufacturers of and dealers in electrical apparatus and goods, etc. Directors: B. D. Parsons and J. T. Bell. Regd. office: 14, Florence Road, Sanderstead, Surrey.

Lawrences Liverpool, Ltd.—Registered 22nd November. Capital £100. Wireless, television, telephonic and telegraphic engineers, etc. Directors: A. W. Owers and R. M. Smith. Regd. office: 61, Byrom Street, Liverpool, 3.

W. & G. (Surbiton), Ltd.—Registered 29th November. Capital £100. Mechanical, constructional, motor, electrical and general engineers, founders, etc. Subscribers: F. H. Worters and J. S. Guthrie. Regd. office: 29, Mincing Lane, E.C.3.

Bankruptcies

R. V. Perry, 2A, Bingham Corner, Croydon, Surrey, electrical engineer.—First meeting held 19th December. Public examination 15th February at the County Court, Scarbrook Road, Croydon.

STOCKS and SHARES

THE Christmas holiday provides a breathing space for Stock Exchange markets which have been, for the past few weeks, in a condition of perpetual uncertainty. Prices have been moving erratically. Business comes in spasms. The constant advance in the prices of raw materials acts in restraint of enterprise and optimism. On the other hand, it is generally recognized that there looms a Budget in sight which will, in all probability, go some way towards re-imposing strict limitation of dividends from distributable profits. Hence, the difficulty of reading the outlook with any degree of assurance becomes daily more difficult. Holders of good stock elect, generally speaking, to retain their interest, the result being that, in more cases than might be supposed, the greater difficulty is to buy stock in any considerable amounts, than it is to sell it.

Globe Telegraph & Trust

Since the first week of this month, Globe Telegraph stocks have been quoted in the form in which they emerged from the big capital reconstruction which resulted, in turn, from the Cable & Wireless Company's reorganization. The preference stock has disappeared, and the new 4 per cent debenture has started life at about a point over par. Dealings in the £1 ordinary shares, now quoted ex the cash and stock distributions, are taking place around 20s. Interest turns now to the question of ordinary dividends. Guidance is available from Sir Edward Wilshaw's statement at the time of the capital operation. The company's estimates of stockholders' income, he said, would be realized only if a dividend at the rate of 5 per cent were paid.

Ericssons Ex Bonus

Ericsson Telephone 5s ordinary have been dealt in around 41s since being quoted ex the share bonus of one new for every eight held. On the larger capital, the market hopes to see at least the maintenance of the tax-free dividend at 20 per cent. This rate has been paid regularly since it was reduced from 25 per cent at the beginning of the war. Over the three calendar years to 1949, trading profits were nearly trebled, the last earnings representing 130 per cent on the £375,000 ordinary capital. Reserves topped the million mark, and still retain impressive proportions after the bonus. Repetition of the former rate of dividend would be equivalent to paying an extra 2½ per cent on last year's capital. It would afford a gross yield of £4 8s 9d per cent on the shares at their present prices. Results for 1950 are due next March.

Phœnix Telephone & Electric

Particulars of this company were published recently as a preliminary to the marketing of the 5½ per cent first preference and 5s ordinary shares. They show that the operating company's business is concerned largely with telephone apparatus, and has been expanded to include a range of domestic and other electrical appliances. Of the group's present output more than half, in value, is accounted for by the first category, while 44 per cent of the second is at present exported. Profits over the three years to February, 1949, averaged £73,000 before tax. On this figure, the preference dividend is covered nearly six times, and on the assumption that it will be at least maintained in the current year, a 10 per cent ordinary dividend is indicated. Dealings started on the basis of 7s 3d for the ordinary and 21s 6d for the first preferred.

Electricity Overseas

In paying last month a final dividend, making 7 per cent for 1949, the East African Power & Light Company accomplished the maintenance of the same rate of dividend on ordinary capital almost exactly quadrupled, by successive issues, over a period of fifteen years. There is little evidence of any check to the rate of progress. Profits in 1949 rose by an additional 50 per cent and the board is taking steps for further increases of capital to keep step with the continuous process of financing extensions and developments. At 37s the £1 shares pay 3¾ per cent on the money, a return which may be influenced by the company's overseas domicile. This not only frees profits from U.K. taxation, but makes the shares attractive to overseas residents.

General Cable Accounts

A yield of nearly 9 per cent is shown by General Cable Manufacturing 5s ordinary shares at 16s 9d. Dividends for the year ended last September totalled 18 per cent on capital increased since last year by the two-for-three capital bonus. The amount distributed is the same as before, and is shown by the recent published accounts to represent roughly half the surplus available. Profits were maintained at a little above last year's, and £23,000 was added to reserves and carry-forward. The capital of the company is £200,000, including £75,000 in 6 per cent preference shares of 10s each. These are available in a small way at 13s 6d, to yield £4 9s per cent.

Hoover Bonus

IT is announced that Hoover, Ltd., have obtained sanction to the issue of a 100 per cent scrip bonus to ordinary share and stock holders. It will be effected by capitalizing £975,000 of reserves.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1942

17312. Sperry Gyroscope Co., Inc.—Object detecting and locating systems utilizing reflection of electro-magnetic waves. 4th December, 1942. (648881.)

1944

12765. Sperry Gyroscope Co., Inc., and Stevens, A. H. (Sperry Gyroscope Co., Inc.).—Directional electro-magnetic wave antenna apparatus. 4th December, 1942. (Divided out of 648881.) (648882.)

1946

6987. General Electric Co., Ltd., and Nelson, E. H.—Cooling means for electric discharge lamps and associated equipment. 11th April, 1949. (648954.)

7533. British Thomson-Houston Co., Ltd.—Generation of electro-magnetic waves. 11th March, 1946. (649085.)

12657. Philips Lamps, Ltd.—Electron-emitting electrodes for electric discharge tubes. 26th April, 1946. (648955.)

17670. Ross, I. D. H. (Steam Torch Corporation).—Superheating vapours by electricity. 12th June, 1946. (648957.)

32987. Sperry Gyroscope Co., Ltd., and Summerlin, F. A.—Electronic cascade amplifiers energized by alternating current. 27th October, 1947. (648884.)

37404. Igranic Electric Co., Ltd.—Control systems for polyphase alternating current electric motors. 19th December, 1946. (649092.)

1947

3673. Philips Lamps, Ltd.—Electric discharge tubes. 7th February, 1947. (648962.)

6695. Radio Corporation of America.—Radio altimeters and other radio distance measuring systems. 10th March, 1947. (649025.)

14860. Skytte, E.—Method and apparatus for electric arc-welding. 5th June, 1947. (649095.)

14893. British Thomson-Houston Co., Ltd.—Transformer tap changing under load systems. 5th June, 1947. (649096.)

19118. Hoover, Ltd.—Suction cleaners. 17th July, 1947. (648967.)

21022. Standard Telephones & Cables, Ltd.—Remote control systems. 1st August, 1947. (Addition to 644128.) (648894.)

22048. British Thomson-Houston Co., Ltd.—Refrigerating systems. 8th August, 1947. (649099.)

25509. Marconi's Wireless Telegraph Co., Ltd.—Electrical wave transmission systems. 18th September, 1947. (648970.)

26841. Harland Engineering Co., Ltd., and Anderson, H. H.—Water turbines. 6th October, 1947. (648899.)

27519. M-O Valve Co., Ltd., Hayes, A. G., and Moore, R. C.—Thermionic valves. 13th October, 1948. (648972.)

28136. British Thomson-Houston Co., Ltd.—Circular lighting fixtures. 21st October, 1947. (648974.)

31313. General Electric Co., Ltd., and Willoughby, A. H.—Circuit arrangements for operating gas- or vapour-filled electric discharge devices. 26th November, 1948. (648857.)

31854. Philips Electrical, Ltd.—Circuits for automatic frequency correction. 2nd December, 1947. (648858.)

32606. Rockwell Manufacturing Co.—Automatic fluid sampling apparatus with electric timing mechanism. 10th December, 1947. (648860.)

33131. Metropolitan-Vickers Electrical Co., Ltd., Smethurst, H., and Millen, T. S.—Fluid valves. 14th January, 1949. (648978.)

33833. British Thomson-Houston Co., Ltd.—Electric thermostats. 22nd December, 1947. (649117.)

34651. Skoda Works, National Corporation.—Electric circuit for the measurement of linear dimensions according to the capacity principle. 30th December, 1947. (648981.)

34901. Hansen, H. G.—Electric thermo-switch for fire alarm systems. 30th December, 1947. (Addition to (647359.) (648983.)

35379. Denes, P.—Electric condensers. 31st December, 1947. (648866.)

1948

523. British Thomson-Houston Co., Ltd., and Adams, W. S.—Slipping clutches. 16th February, 1949. (649131.)

1735. British Thomson-Houston Co., Ltd.—Vinylmethylnaphthalenes. 20th January, 1948. (649040.)

1875. British Thomson-Houston Co., Ltd.—Polymers of vinylmethylnaphthalenes. 21st January, 1948. (649041.)

2835. Philco Corporation.—Band-pass coupling circuits. 30th January, 1948. (649136.)

2875. Marconi's Wireless Telegraph Co., Ltd., Keall, O. E., and Miller, W. F.—Band-pass impedance transforming networks for use on high frequencies. 19th October, 1948. (648911.)

4969. Trico-Folberth, Ltd., and Vickerson, G. E.—Electric switches suitable for vehicle traffic indicators. 21st February, 1949. (648914.)

5151. Guardian Electric Manufacturing Co.—Preselector. 20th February, 1948. (648867.)

5478. Metropolitan-Vickers Electrical Co., Ltd.—Overload protective systems for X-ray generators. 24th February, 1948. (648916.)

5719. Marconi's Wireless Telegraph Co., Ltd.—Gain control circuits for television receiving apparatus. 26th February, 1948. (649141.)

5939. Department of Commerce, Director of the Office of Technical Services of.—Phonograph apparatus made particularly for telemetering purposes. 27th February, 1948. (649048.)

5997. Department of Commerce, Director of the Office of Technical Services of.—Telemetric system for meteorological data. 27th February, 1948. (649049.)

6292. Hazeltine Corporation.—Self-quench superregenerative wave-signal receiver. 28th February, 1948. (648920.)

6332. Guardian Electric Manufacturing Co.—Impulse operated selector switch for alternating and direct current. 28th February, 1948. (649143.)

6333. Guardian Electric Manufacturing Co.—Preselector. 28th February, 1948. (648851.)

6715. British Broadcasting Corporation, Baker, H. W., Campbell, D. R., and Whiting, H. G.—Recording of television signals. 18th December, 1948. (648924.)

6860. Philips Electrical, Ltd.—Discharge tube oscillator circuits. 5th March, 1948. (648925.)

9559. Siemens Electric Lamps & Supplies, Ltd., Wilkinson, E. L. G., and Jones, R. D.—Electrical excess voltage protective devices. 1st April, 1949. (648997.)

9736. Standard Telephones & Cables, Ltd., and Frankton, W. J.—Twin valve amplifiers. 1st April, 1949. (648869.)

10123. Radio Corporation of America.—Wave-guide system. 12th April, 1948. (649151.)

10571. Breton Engineering Co., Ltd., and Byron, L. B.—Electric toasters. 13th April, 1949. (649005.)

10641. British Thomson-Houston Co., Ltd.—Resinous coating compositions for magnetic materials. 16th April, 1948. (649051.)

10806. Stanford, W. E.—Television receivers. 19th April, 1949. (Cognate application, 3463, 8th February, 1949.) (649006.)

11835. Marrs, T. J. D.—Thermostats for controlling electrical heating apparatus. 30th April, 1949. (649011.)

12831. Allen, M.—Electrical storage batteries. 10th June, 1949. (649053.)

13066. Metropolitan-Vickers Electrical Co., Ltd.—Fluid-control valves. 12th May, 1948. (649161.)

13614. Singer Manufacturing Co.—Control apparatus for radio-frequency heating. 19th May, 1948. (649164.)

13862. Kent, Ltd., G.—Manufacture of glass electrodes. 21st May, 1948. (Addition to 574029.) (649122.)

16864. Westinghouse Electric International Co.—Electric motor control systems. 23rd June, 1948. (649168.)

16866. Westinghouse Electric International Co.—Electric motor control systems. 23rd June, 1948. (649169.)

17564. Soc. Anon. A. Citroën.—Electro-magnetic braking devices for power driven vehicles. 30th June, 1948. (Cognate application, 17565, 5th May, 1948.) (649172.)

18164. Westinghouse Brake & Signal Co., Ltd., Stevens, S. A., and Duckitt, H.—Apparatus for controlling the supply of current to electro-plating vats and the like. 9th June, 1949. (649175.)

19050. Cyc-Arc, Ltd., and Ainsworth, A. R.—Electric arc stud welding. 15th July, 1949. (649177.)

19772. Nijman, Z. C.—Impulse operated electrical apparatus suitable for use in automatic telephone and like systems. 23rd July, 1948. (648937.)

20005. New Day Electrical Accessories, Ltd., and Davey, L. E. W. C. N.—Electric switches of the micro-gap type. 24th June, 1949. (648875.)

20586. Westinghouse Brake & Signal Co., Ltd., Peter, L. H., Sheppard, E. A., and Stevens, S. A.—Light units for use in light signals or indicators. 2nd June, 1949. (649063.)

20983. Belling & Lee, Ltd., Strafford, F. R. W., and Pateman, J. E.—Aerials. 31st March, 1949. (648938.)

22199. Resistance Welders, Ltd., Cumming, W. R., and Ross, G. A.—Electric welding. 11th August, 1949. (648939.)

24994. Lucas, Ltd., J., and Orme, J. D. L.—Contractable rings for lamp fronts and other purposes. 12th August, 1949. (648942.)

25142. General Electric Co., Ltd., and Bryden, J. E.—Multi-channel electrical signalling systems. 27th September, 1949. (649065.)

26330. Marconi Instruments, Ltd., and Brockelsby, C. F.—Absorption wattmeter arrangements. 8th October, 1948. (648944.)

28853. Watford Electric & Manufacturing Co., Ltd., and Rosington, C. A.—Electro-magnetic relays. 27th July, 1949. (649070.)

31134. English Electric Co., Ltd., Caldbeck, C. J., and Waters, G. E.—Electric motor control systems. 25th November, 1949. (648949.)

31665. Mercvale Engineering Co., Ltd., and Allison, A.—Electric driving of hydraulic propellers, screws or the like. 7th December, 1949. (648950.)

32442. Fitton, Ltd., R. N., and Beaumont, F. H.—Noise limiting circuit arrangements for radio receivers. 22nd November, 1949. (649074.)

1949

30603. British Thomson-Houston Co., Ltd.—Generation of electro-magnetic waves. 11th March, 1946. (Divided out of 649085.) (649130.)

Crystal Valves

AT a meeting of the Radio Section of the Institution of Electrical Engineers in London two papers were presented on crystal valves. In the first of these Mr. R. W. Douglas and Dr. E. G. James (both of G.E.C.) deal with crystal diodes, and commence by enumerating the current views of the manner in which very small amounts of impurities give rise to the special electrical properties of semi-conductors and of the mechanism of contact rectification. The authors then consider the preparation of germanium and silicon for use in crystal diodes and proceed to discuss in terms of theoretical ideas the various steps found necessary in the processing.

The second part of the paper is devoted to describing and discussing the performance and design of a new coaxial-type silicon-crystal diode intended for use as a mixer at frequencies up to about 10,000 Mc/s, and also a wire-ended germanium-crystal diode. Particular attention is drawn to the frequency dependence of the rectification efficiency of the germanium-diode and its substitution for the thermionic diode.

In the second paper Mr. T. R. Scott (Standard Telecommunication Laboratories, Ltd.) first of all reviews the various forms of crystal triode so far developed and comments on their characteristics. He then gives a brief résumé of the various materials proposed and of the types of control which have been applied to modify the characteristics of triodes made therefrom. A discussion of testing procedure is included and in view of the scarcity of information to date on applications and circuit design the paper concludes with a section on this aspect.

Mr. Scott feels that in the crystal triode an interesting and useful electronic component has arrived. It is not really a straight competitor to the thermionic valve but rather a complement to it as in certain cases it can simplify circuit design and power supply, particularly in connection with pulse technique. At a later date the same might be true in connection with low power transmission at medium wavelengths but the position at ultra-high frequencies is at present quite obscure.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Baldock.—8th January. U.D.C. Street lighting equipment. (See this issue.)

Belfast.—19th January. Electricity Department. Fire fighting equipment and 33 kV and lower voltage cables. (See this issue.)

Bridge of Allan.—5th February. Burgh Council. Street lighting equipment. (See this issue.)

Dagenham.—6th January. Borough Council. Electric lamps and supplies for the year commencing 1st April, 1951. Particulars from the borough engineer, Civic Centre.

Hastings.—8th January. Corporation. Electrical installations in 116 houses. (See this issue.)

Lincolnshire.—20th January. County Council. Electrical work at Stoke Rochford Hall, Kesteven Training College. (See this issue.)

London.—24th January. Metropolitan Water Board. L.v. switchboard at Ashford Common pumping station. (See this issue.)

WANDSWORTH.—3rd January. Borough Council. Supply of electric lamps and electrical works for varying periods from 1st April, 1951. Particulars from R. H. Jerman, town clerk, Municipal Buildings.

Walsall.—6th January. Borough Council. Electrical equipment for Footherley Hall residential nursery. Particulars from L. J. Joseph, children's officer, 29, Leicester Street.

ORDERS PLACED

Cowes (I.o.W.).—U.D.C. Installation of Class "A" street lighting from the Ferry to Crossways via York Avenue (£2,699).—Southern Electricity Board.

Flintshire.—Education Committee. Electrical installation at new technical college, Kelserton (£29,065).—Rashleigh Phipps & Co., Ltd.

Glasgow.—Corporation Transport Committee. Rectifier plant for the Merrylee Road substation (£26,915).—General Electric Co.

Education Committee. Electric lighting and heating installation, etc., at the central kitchen, Clydeferry Street (£505).—Corporation Central Electrical Workshops

Herefordshire.—County Council. Recommended. Electrical installation at Ross Secondary School (£6,249).—Conroy & Owen, Ltd., Cheltenham.

Jarrow-on-Tyne.—Corporation. Installation of 579 street lighting units at the South Leam Lane estate (£2,034).—North Eastern Electricity Board.

Newcastle-on-Tyne.—Education Committee. Electrical installation at the new Montagu Primary School (£5,232).—T. Mitchelson (Electrical), Ltd., Gateshead.

Newcastle (Staffs).—Corporation. Electrical installations in houses at Bradwell, Clayton and Silverdale (£1,768).—Newcastle Electric Co.

Northumberland.—County Council. Electrical installations at new county modern school, South Farm, Blyth (£6,041).—B. French, Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barnsley.—Houses (52), New Lodge estate for T.C.; C. F. Ibbotson, Windyridge, Windmill Lane, Wombwell (18), T. H. Watford, 40, Lundhill Road, Wombwell (34).

Blackpool.—Houses (22) for B.C.; T. Bannister & Sons, 176, Queen's Drive, North Shore. Ten aged persons' bungalows; N. A. Robson, Ltd.

Bury.—Houses (30), Brandlesholme No. 3a site for B.C.; Middleton & Co. (Blackpool), Ltd.

Chester.—B.C. First instalment of shopping centre at Blacon; C. Greenwood, city surveyor.

Chesterfield.—New buildings at cattle market for B.C.; C. E. Gaunt & Sons, Ltd., Chesterfield.

Coventry.—T.C. Health centre (£175,000) and three day nurseries at Monks Park, Canley, and Windmill Road (£50,000); D. E. E. Gibson, city architect.

New church of St. Paul at Foleshill; Sir Charles Nicholson and T. J. Rushton, architects, 2, New Square, Lincoln's Inn, London, W.C.2.

Central College of Art and Technology (seven-storey building), on site near Priory Street (£350,000); D. E. E. Gibson, city architect, 1a, Warwick Row.

Departmental stores and offices (£350,000); British Home Stores, Ltd., 129, Marylebone Road, London, N.W.1.

Rural police stations at Thursby and Wetherall; J. A. Graham, Carlisle.

Doncaster.—Gymnasium, Balby Modern Secondary School for E.C.; Hemsworth Bros., 62, Ravensworth Road, Doncaster.

Droylsden.—Flats (52) at Moorside estate for U.D.C.; W. Chappell & Sons, Ltd., Droylsden.

Huyton (Lancs).—St. Columba's R.C. School; F. X. Velarde, architect, 3, Abercromby Square, Liverpool.

Irthlingborough.—Houses (38) at Addington Road site; E. Turnbull, surveyor.

Mansfield.—Fire station, Blidworth; county architect, Nottingham.

Menai Bridge.—U.D.C. Shops, flats and houses (36); T. Alwynn Lloyd, architect, Cardiff.

Middlesbrough.—Primary school at Green Lane, secondary school at Middle Beck and R.C. primary school for the Brambles-Thorntree estates; borough education architect.

Milnrow.—U.D.C. Flats (50) at Dalton Avenue, Firgrove; K. P. Lewin, surveyor.

Newcastle-on-Tyne.—First stage of new Town Hall and offices scheme at Barras Bridge (£461,000); city architect, 18, Cloth Market.

Houses (18), Vancouver Drive, for J. T. Bell & Sons; C. Solomon, St. Mary's Place, Newcastle-on-Tyne.

Nottingham.—Houses (1,200) at Clifton estate for T.C.; G. Wimpey & Co., Ltd., London.

Portsmouth.—Primary school, Langstone; city architect.

Rickmansworth.—Sub-divisional police station (£36,998) for Herts C.C.; Universal Housing Co., Ltd., builders, Bury Street, Rickmansworth.

Rotherham.—Houses (72), Broom Valley estate for B.C.; O. Weaver & Sons, Ltd., Haslington Road, Rotherham.

Royston.—Houses (28) at Grove site for U.D.C.; Royston Builders, Ltd., North Road, Royston, near Barnsley.

Rugeley (Staffs).—Adaptations at Mansfield for hostel for the blind; Staffordshire county architect, County Buildings, Stafford.

St. Albans.—Reconstruction of Institute of Agriculture and Horticulture, Oaklands; county architect, County Offices, Hertford.

Salford.—Primary school, Duke Street for E.C.; Cruikshank and Seward, architects, Manchester.

Southend-on-Sea.—Comprehensive school, Belfairs; architect, Municipal Buildings Annexe, 30, Alexandra Street.

Southport.—E.C. Extensions at Technical College; H. L. Bunting, surveyor.

Stafford.—R.D.C. Conversion of Wheaton Aston Polish Hostel as 120-150 dwelling units; G. M. Lawton, surveyor.

Stoke-on-Trent.—Hanley High School (£325,000) for E.C.; G. Percy Trentham, Ltd.

Stratford-on-Avon.—Houses (54) at Wellesbourne site; P. C. Smart, borough engineer.

Sunderland.—R.C. school at Grindon; borough architect.

Sutton and Cheam.—Houses (52), off Greenhill Road, Sutton; N. H. Michell, borough surveyor, High Street, Sutton, Surrey.

Sutton-in-Ashfield.—Houses (142) and bungalows (26), Mansfield Road; M. D. Sweeney & Palmer, Ltd., Beechdale Road, Aspley, Nottingham.

Trowbridge.—Houses (44), Studley Green, for U.D.C.; Snailum, Huggins & Le Fevre, 18, Brook Street, Bath.

Tynemouth.—Additions to the Priory School for the E.C. (£10,000); W. Stockdale, architect, 73, Howard Street, North Shields.

Additions to Tynemouth High School (£33,000); O. A. Wainwright, quantity surveyor, 87, Westgate Road, Newcastle-on-Tyne.

Factory for repairing farm machinery, Waterville Road, for Neville Engineering Co., Ltd.; W. Stockdale, architect.

Usk (Mon).—Sessions house, for Standing Joint Committee; C. L. Jones, county architect, Queen's Hill, Newport, Mon.

Wakefield.—Central bus station (£60,000); West Riding Automobile Co., Ltd., Central Offices.

West Bridgford.—Flats (16) at Valley Road estate for U.D.C.; Progressive Builders, Ltd., Carlton, Notts.

West Riding.—E.C. (1951/52 programme) Keighley Technical College (£125,000), Harrogate School of Art (£125,000), conversion and extensions at Wells House, Ilkley (£70,000), dental clinic at Wakefield (£6,500); H. Bennett, county architect, Wakefield.

Winchester.—New county office building for Hampshire C.C.; C. Cowles Voysey, architect, 2, Bunkers Hill, N.W.11.

FUEL RESEARCH

THE report of the Fuel Research Board together with the report of the Director of Fuel Research for the years 1939–46 is now available from H.M. Stationery Office, price 3s (postage 2d). At the outbreak of the war the whole of the experience and information of the Fuel Research Organization was held available for application to the war effort and in a comparatively short time practically the whole of the staff were engaged on wartime programmes, widely varying in character. These are described in the present report; they included projects concerned with requirements of coal possessing special properties and the substitution of fuels to conserve certain types of coal and to eliminate unnecessary transport. Assistance was also given to the Sulphuric Acid Control of the Ministry of Supply in the recovery of pyrites from coal. Other work embraced the hydrogenation of coal and tar, investigations on incendiary materials for war purposes and the development of devices for the elimination or reduction of smoke discharged from the funnels of ships.

Another successful investigation was that relating to the problems arising from the deposition of solid matter on the external heating surfaces of boilers in power stations. This work was carried out in co-operation with the Boiler Availability Committee, consisting of representatives of the Central Electricity Board, the electricity generating industry, manufacturers of water-tube boilers, and the British Coal Utilization Research Association.